NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

MINE BURIAL EXPERT SYSTEM FOR CHANGE OF MIW DOCTRINE

by

Christopher M. Beuligmann

September 2011

Thesis Advisor:	Peter C. Chu
Second Readers:	Ronald E. Betsch
	Peter Fleischer

Approved for public release; distribution is unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			*Form Approved OMB No. 0704–0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202–4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704–0188) Washington DC 20503.			
1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** September 2011	**3. REPORT TYPE AND DATES COVERED** Master's Thesis	
4. TITLE AND SUBTITLE Mine Burial Expert System for Change of MIW Doctrine			**5. FUNDING NUMBERS** N6230610PO00123
6. AUTHOR(S) Christopher M. Beuligmann			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943–5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Oceanographic Office Stennis Space Center, MS 39529 - 6000			**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB Protocol number ____N/A____________.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			**12b. DISTRIBUTION CODE**

13. ABSTRACT

Mine impact burial models such as IMPACT25, IMPACT28, and IMPACT35 have been used in the MIW community in an attempt to calculate the percentage of impact burial for sea mines. Until recently the models have been deterministic, using parameters such as sediment type, air and sea trajectories, drop angle, and mine type to calculate the percentage of burial. These models have been relatively effective in calculating impact burial, but little attention has been given to the temporal effects on mine burial, known as scour burial. Another shortfall of the deterministic modeling approach is the inability to capture the stochastic nature of the input parameters. To address these issues the John Hopkins University – Applied Physics Laboratory (JHU-APL), in conjunction with the NRL has developed the Mine Burial Expert System (MBES).

The MBES is a Bayesian network of physics based, deterministic models, observational data, and expert opinion. It provides the opportunity to give input parameters as probability density tables (PDTs) and receive a burial percentage as an output distribution. This allows its user to capture the variability of input parameters and converge them into variability in the burial prediction, providing valuable risk data to the mine countermeasure (MCM) Commander. The MBES has been incorporated into the Environmental Post Mission Analysis (EPMA) tool for Naval Oceanographic Office (NAVO), which could give the MCM planners an idea of the confidence level of its predictions. To understand how the variability and confidence levels can be used and how it may affect current doctrine, a series of tests have been run through the MBES. A thorough review of the results can have a significant effect on future use of the system and subsequent changes to MIW doctrine. In particular, current doctrinal sediment categories are not sufficient in capturing the resolution of the MBES predictions.

14. SUBJECT TERMS Mine Burial Expert System, stochastic model, mine burial prediction, physical oceanography			**15. NUMBER OF PAGES** 160
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UU

NSN 7540–01–280–5500

Standard Form 298 (Rev. 2–89)
Prescribed by ANSI Std. 239–18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

MINE BURIAL EXPERT SYSTEM FOR CHANGE OF MIW DOCTRINE

Christopher M. Beuligmann
Lieutenant, United States Navy
B.S., Roger Williams University, 2005

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN PHYSICAL OCEANOGRAPHY

from the

NAVAL POSTGRADUATE SCHOOL
September 2011

Author: Chris Beuligmann

Approved by: Peter C. Chu
Thesis Advisor

Ronald E. Betsch
Peter Fleischer
Second Readers

Jeffrey Paduan
Chair, Department of Oceanography

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

Mine impact burial models such as IMPACT25, IMPACT28, and IMPACT35 have been used in the MIW community in an attempt to calculate the percentage of impact burial for sea mines. Until recently the models have been deterministic, using parameters such as sediment type, air and sea trajectories, drop angle, and mine type to calculate the percentage of burial. These models have been relatively effective in calculating impact burial, but little attention has been given to the temporal effects on mine burial, such as scour burial. Another shortfall of the deterministic modeling approach is the inability to capture the stochastic nature of the input parameters. To address these issues the John Hopkins University – Applied Physics Laboratory (JHU-APL), in conjunction with the NRL has developed the Mine Burial Expert System (MBES).

The MBES is a Bayesian network of physics based, deterministic models, observational data, and expert opinion. It provides the opportunity to give input parameters as probability density tables (PDTs) and receive a burial percentage as an output distribution. This allows its user to capture the variability of input parameters and converge them into variability in the burial prediction, providing valuable risk data to the mine countermeasure (MCM) Commander. The MBES has been incorporated into the Environmental Post Mission Analysis (EPMA) tool for Naval Oceanographic Office (NAVO), which could give the MCM planners an idea of the confidence level of its predictions. To understand how the variability and confidence levels can be used and how it may affect current doctrine, a series of tests have been run through the MBES. A thorough review of the results can have a significant effect on future use of the system and subsequent changes to MIW doctrine. In particular, current doctrinal sediment categories are not sufficient in capturing the resolution of the MBES predictions.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

CPT	Conditional Probability Table
EPMA	Environmental Post-Mission Analysis
IBPM	Impact Burial Prediction Model
JHU-APL	Johns Hopkins University Applied Physics Laboratory
MBES	Mine Burial Expert System
MBPP	Mine Burial Prediction Program
MCM	Mine countermeasures
MEDAL	Mine Warfare Environmental Decision Aid Library
MIW	Mine Warfare
NAVO	Naval Oceanographic Office
NRL	U.S. Naval Research Laboratory
ONR	U.S. Office of Naval Research
PDT	Probability Density Table
PEO LMW	Program Executive Office Littoral and Mine Warfare
WBIED	Waterborne Improvised Explosive Device
WISSP	Wave Induced Spreadsheet Prediction

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

I must begin by giving thanks to the most important parts of my life. I thank God for blessing me with the opportunity to attend NPS and learn things that some people dream of. Thanks to my wife and friend Mollie for loving me, encouraging me, and always being there for me when I needed it the most. Thanks to my son Caleb, who was born about halfway through my thesis. He has taught me things I could never have learned at NPS and is an inspiration to be the best man I can be. Thanks to friends of Officer Christian Fellowship for their support both personally and professionally during my time in Monterey.

There are so many fine people in my professional world that also deserve my thanks for their support, knowledge, and time as I completed my thesis. Thanks to Professor Peter Chu and Mr. Chenwu Fan from NPS for their guidance and assistance in formatting, MATLAB, and for leading me through the whole process. Professor Chu was the perfect advisor for me and gave me the exact amount of guidance I needed. Thanks to Dr. Peter Fleischer and Ron Betsch from NAVO. My visit with them in September of 2010 was excellent and really got me started on the right foot. Thanks to Bruce Lin, Paul Elmore, and Dwayne LaVigne from NRL for continuous support with the expert system in EPMA and Netica. They have my deepest appreciation for what they have done and continue to do in order to give this capability to the fleet. Thanks to Nathaniel Plant from the United States Geological Survey, who has been an integral part of MBES from the beginning. I appreciate his eagerness to help me learn and excel throughout my work. Thanks to Lieutenant Patrick Kilcrease, Commander Mike Feyedelem, Professor Mike McMaster, and Captain John Schultz who were all in the right place at the right time and believed in me. I would not be here without them. Lastly, thanks to Professor Daphne Kapolka, who has challenged me even before I received orders to NPS and has given me the most sincere support and encouragement as I worked through my courses.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

Mine warfare can be described as the strategic, operational, and tactical use of sea mines and the countermeasures to defeat them. Its history can be traced back to "Greek Fire" used to defeat Constantinople in the year 673. Early American experiences include the use of "torpedoes" in the Revolutionary War, the War of 1812, and the Civil War. Although many of the early mines were innovations by individual commanders, their lethality and effectiveness were just as significant as they are today. Despite the tendency to neglect mine warfare and the attempts to focus on more advanced and trendy weapons, sea mines have proven to be the most successful weapon against surface ships.

The discipline of mine warfare can be divided into four broad categories: active mining, passive mining, mine hunting, and mine sweeping. Whereas active and passive mining many times prelude hostilities or aggressive actions, mine hunting and mine sweeping occur constantly and are not associated to wartime or peace. This reality comes from the fact that laying a cluster of sea mines takes hours, and finding or sweeping one mine takes days. The search for mines will never be exhausted because so many of them were deployed in our world's history and it takes so long to find them. Sea mines have always posed a threat to naval forces. They affect our ability to control sea lanes, project power, and secure areas vital to our national security. A more recent problem comes in the form of waterborne improvised explosive device (WBIED). These devices are as relatively inexpensive and innovative as the first mines in history, and they are just as effective. Sea mines and WBIEDs are also a threat to global commerce. With today's economic challenges, terrorists or nation states could have a larger impact on a single country by targeting merchant mariners than naval forces. Although mine warfare is not considered a top priority, these are all justifiable reasons why it should be.

Mine hunting and mine sweeping are terribly time consuming endeavors. Technology and increased knowledge of ocean physics have significantly aided in our ability to detect and neutralize mines, but one can never clear an area with complete confidence. Mine hunting in particular has evolved greatly over the past 20 years, with

the formation of advanced models and sonar systems. One key to successful mine hunting is in understanding and characterizing the sea floor. The sea floor affects everything from the expected amount of mine burial upon impact to the effectiveness of the sonar system in detecting the mine. The percentage of mine burial is of particular importance for this research, and has been a topic of discussion in many seminars and papers.

The most important factor controlling the degree of burial upon impact was determined to be the shear strength of the sediment [1]. Other parameters that have been studied, and do in fact have an influence on impact burial are depth of the water column, mine type, and the initial drop angle. Also of concern with regards to mine burial is the issue of subsequent or scour burial. Impact burial and scour burial occur in different environments. Impact burial is dominant in areas with high porosity, muddy sediments with a low shear strength value and scour burial occurs around lower porosity, sandy bottoms with a high shear strength value. Both of these processes are difficult to model, and we are limited in our ability to represent these processes even with today's technology. Impact burial has been studied and modeled since Arnone and Bowen developed the Impact Burial and Prediction Model (IBPM) for the U.S. Navy in the late 1970s [2]. The IBPM and subsequent models IMPACT25/28/35 all model three phases: falling through the air, falling through the water, and bottom impact. The biggest shortfall with all of these models is that they are all deterministic. In predicting mine burial, some of the models have shown great skill when all parameters were well quantified. Because they are deterministic, these models were not equipped to deal with uncertain input parameters. To overcome such deficiency, the Mine Burial Expert System (MBES) was developed by Johns Hopkins University on the base of Monte Carlo simulations and Bayesian networks.

The MBES provides a state of the art capability for mine burial prediction. It predicts both impact and scour burial with great accuracy. It uses the previously mentioned deterministic models and full scale field and laboratory data in an expert system framework to provide mine burial probabilities that account for variability in deployment, environmental, and geophysical parameters. The MBES was funded by the

ONR MBPP and transitioned to NAVO upon completion. The transition was used to take the MBES and apply it to scenarios that are relevant to NAVO. After completion of the transition, NAVO began implementing the MBES in the EPMA tool. This implementation is ongoing and will allow NAVO to utilize the MBES with their existing file formats and data. Once complete, the EPMA tool will be a valuable operational planning tool for impact and scour burial predictions. Fleet MIW operators need the EPMA tool in order to provide MEDAL with the most accurate burial prediction.

One of the complications that has come with the implementation of the MBES comes from the difference in the output of the prediction models. Previous models had a single value for mine burial that fell into one of four bins. These bins are characterized in MEDAL sediment categories, which lead to a specific bottom type. The burial category, along with bottom clutter, local geology, and other factors determine the time and resources required for mine hunting. In extreme cases, these factors can lead to the decision to alter operations significantly or completely avoid an area. With the MBES, burial predictions come from an output PDT with ten bins. In many cases, the mean burial calculated in the MBES falls on the edge of an existing MEDAL sediment category, with some of the area of the PDT in one bin, and some in another. Although the PDT accurately predicts the probability of burial, it is difficult at best to determine which doctrinal bin to assign it to. Choosing one bin over the other would have a huge effect on the resources required for the operation.

The purpose of this research was to determine the optimal binning scheme to capture the output of the MBES, while keeping the integrity and effectiveness of current doctrine. This was accomplished by analyzing various configurations of the MBES and its output distributions as well as how the MBES is used in full scale MCM planning.

THIS PAGE INTENTIONALLY LEFT BLANK

II. MINE WARFARE OVERVIEW

A. HISTORY AND SIGNIFICANCE

Sea mines have been in use for over 200 years. They are an inexpensive but effective way to shape naval operations, many times without even putting friendly forces in harm's way. The first naval mine**s** were developed and deployed by David Bushell in 1777 for use against a British fleet anchored in the Delaware River above Philadelphia. His "torpedoes" were nothing more than two floating kegs of gunpowder with contact firing mechanisms, but they served their purpose. In the summer of 1977, he rigged an array of two "torpedoes" to attack the British warship Cerberus. The British prize crew of a captured American schooner saw the mines and attempted to retrieve them, killing most of the crew and sinking the schooner. This incident may have been the source of the phrase, "any ship can be a minesweeper, once." The first successful U.S. mining occurred during the war of 1812, when sea mines denied British forces access to the Port of New York [3].

Sea mines played a significant role on both sides of the American Civil War. The Confederate Navy, inspired by the low cost of mines, used them as their primary weapon and was able to deny the larger Union Navy access to many southern harbors. The Union Navy in turn developed mine countermeasures such as reconnaissance, mine hunting with small boats, and reproduction of captured mines to level the playing field. By the end of the Civil War over 25 Union ships and 11 Confederate ships were sunk by mines, showing that independent mines do not discriminate against their targets. Mines continued to play a significant role in naval history, with either side employing them in the Spanish-American War, the Russo-Japanese War, and both World Wars. In World War I, Russia, Germany, Turkey, Great Britain, and the United States relied heavily on sea mines. In October of 1917, the U.S. Navy ordered 100,000 mines to lay a minefield across the North Sea to prevent the German U-boats from transiting into the Atlantic Ocean. Sea mines were more advanced by this period and most of the mines used in this minefield were a moored mine called the Mk 6 (Figure 1). Up to that point, the German

U-boats were wreaking havoc on merchant vessels crossing the Atlantic for resupply of forces. The minefield saw many technical difficulties and delays, but was complete with more than 76,000 mines on October 26, 1918. Recent naval exercises have still found mines left over from this operation.

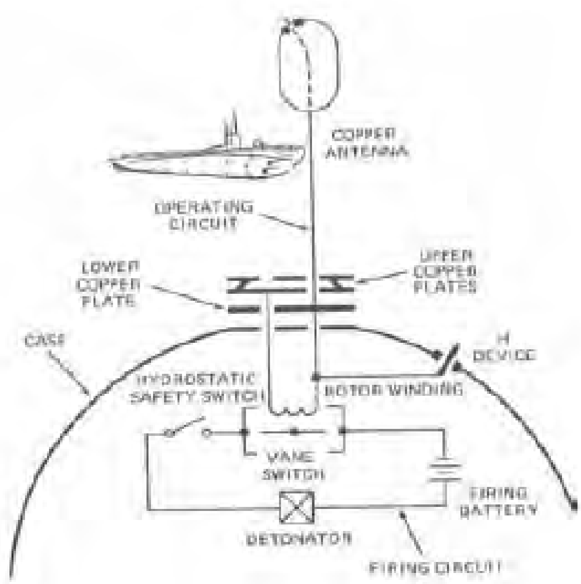

Figure 1. Diagram of a moored mine similar to those used in WWI. From [4].

In World War II, Allied Nations primarily used the Mk 25 mine. The Mk 25 was airdropped from B-29 bombers and carried up to 1,120 pounds of TNT. This mine was instrumental in “Operation Starvation,” where U.S. forces mined the waters in and around the Japanese Islands and prevented commercial vessels from leaving or entering Japanese harbors. Along with the Mk 25 mine, advance magnetic, acoustic and pressure influence and electrical-potential/antennae-fired mines were used in the war by both sides.

As sea mines continued to develop, mine countermeasures tried to keep with the pace. The U.S. Navy developed measures such as degaussing of warships, paravanes, several different mechanical, magnetic, and acoustic sweeps, and vessels made specifically for countering mines. As previously discussed, clearing mines in an extremely costly endeavor, both in time and money. After hostilities cease, sweeping the

harbors for leftover mine takes years and is rarely accounted for in the war budget. By October of 1945, U.S. Navy MCM forces had swept over 10,000 contact mines in the Atlantic and Pacific theaters. It took hundreds of U.S. and Japanese mine sweepers to search for the mines laid during "Operation Starvation" and many influence mines remain in Japanese waters today. This illustrates how vital mine countermeasures are to war and postwar operations. A consistent focus on MCM would increase effectiveness of its forces and reduce the resources needed to clear mines.

Another indicator of U.S. shortfalls in MCM history came with the Korean War. From the end of World War II to the beginning of the Korean War in 1950, U.S. Navy minesweepers went from a force of 500 ships to 15 ships. Task force commanders in the Korean conflict were frustrated and hamstrung by the plethora of mines laid by North Korean forces. Even with a force of 250 mine sweeping ships from the United Nations, mine sweepers in the Korean War were incapable of being an effective force. By the armistice in 1953, MCM forces accounting for 2% of the total force also accounted for 20% of naval casualties. Then Chief of Naval Operations Admiral Forrest Sherman may have been the most instrumental figure in U.S. Naval history for the transformation of mine warfare. He started a program designed to revive the Navy's MIW capabilities that sustained research and development, experimentation, and acquisition efforts through the 1970s. The Navy took delivery of another 250 surface MCM vessels and, for the first time, several rotary wing MCM platforms. With incentive coming from a resurgent Soviet Navy, new technologies in mines were also developed including advanced multiple-influence mines.

Destructor mines were the first mine to be used on land and in the sea. When dropped on land, they buried themselves in the ground on impact and could be activated by passing military forces. When dropped in rivers, canals, or harbors they fall to the seafloor and can be activated by a variety of vessels. Over 300,000 Destructor mines were dropped from U.S. aircraft during the Vietnam War. These mines were instrumental in leading to the 1973 Paris Peace Accord and the end of the Vietnam War. Once again, the mines had to be cleared after the hostilities had ceased and this required a

great amount of MCM air and surface resources. The United States agreed to a seven month operation, led by Task Force 74 that was the first extensive use of mine countermeasure helicopters.

There are many examples of terrorists or failed states that have used or threatened to use mines and WBIEDS to inflict fear or hardship. One such example is the "patriotic scuba crisis" of 1980. President Jimmy Carter announced a Soviet grain embargo to teach them a lesson after they occupied Afghanistan in December of 1979. In the following month, an unknown person claiming to be the patriotic scuba diver said he had planted a mine in the Sacramento River. All traffic on the river was stopped and the USS Gallant (MSO-489) spent four days scanning the water. A mine was never found, but the damage had already been done. The impact on commercial shipping was estimated in the hundreds of thousands of dollars.

Possibly the greatest example of terrorism from mining came in the summer of 1984. From July to September over twenty vessels reported underwater explosions on or near their vessels in the Red Sea and Gulf of Suez. A huge international response followed, including Egypt, France, Great Britain, Italy, the Netherlands, the Soviet Union, and the United States. After two months of mine hunting, only one mine was found; it was a Soviet made multiple influence mine that the U.S. didn't even know existed. It was later found that Libyan naval personnel had been wandering through the waterways laying mines for nearly two weeks.

The Iran-Iraq War of the 1980s had significant mining incidents of strategic importance. For the U.S., this period again provided strong evidence that maintaining a rapidly deployable, capable, and effective mine warfare force is essential to maintaining open and secure sea lanes. Iran believed that the U.S. was showing favor to Iraq in the mid 1980's and responded by mining areas in the Arabian Gulf. They achieved success first in July of 1987, when the reflagged supertanker Bridgeton hit a mine. After this incident, the U.S. Navy airlifted eight minesweeping helicopters and six surface minesweepers were sent to the region. Again in 1988, the Iranians mined the southwestern portion of the Gulf and the USS Samuel B. Roberts fell victim to a mine. The explosion cracked the ship down the middle and nearly sank her. During Desert

Storm in 1991, the USS Tripoli (LPH-10) and USS Princeton (CG-59) detonated mines resulting in over 21 million dollars in damages [5]. Prior to the U.S. led coalition build up, the Iraqis were laying more than 1,300 sea mines in the Northern Arabian Gulf. Mine sweeping forces were not sufficient enough to detect and neutralize this number of mines before the conflict began. Again before the second Gulf War, Iraqi naval forces were found to have Italian Manta bottom mines (Figure 2) ready to deploy.

Figure 2. Italian-made Manta mine, bottom moored and actuated by various means.

The final piece of history on mines and WBIEDs is also the most disturbing. In April of 2004, a tugboat operator on Lake Pontchartrain, Louisiana spotting a floating object and called the Coast Guard. After being fished out of the water by the Jefferson Parish bomb squad, they found it to be a crude WBIED made of plastic pipes, explosives, and put in a trash bag for floatation. This situation serves as a reality check for the importance of mine countermeasures. Whether it is the Department of the Navy or Department of Homeland Defense, or both, there must always be an organization poised and funded to respond to this type of incident.

With the emerging Chinese mine threat and the constant threat of terrorism, there is no better reason to start investing in more advanced mines and mine countermeasures. The Chinese Navy is said to have between 50,000 and 100,000 mines consisting of over 30 variants of contact, magnetic, acoustic, pressure, and multi-actuation mines. Some of their mines are reported as being remote controlled, rocket-rising, or mobile. They also have retained the capability of launching mines from their submarines. It would take an

equipped and well-trained MCM force to prevent them from denying access to vital shipping lanes in Southeast Asia. Al-Qaeda has the intent and resources to buy a variety of mines and WBIEDs and use them in U.S. and coalition ports. If they discover a method of deploying these weapons, there is little that could be done by current U.S. MIW assets to find and neutralize them. The potential impact on our unstable economy could be catastrophic.

B. MISSION

The "weapons that wait" are valued by some and underappreciated by most. Apart from the U.S., there are more than a quarter of a million sea mines of over three hundred types and held by more than fifty navies across the world. Over thirty countries still produce mines and over twenty countries export them [3]. These figures do not even touch the millions of WBIEDs that either exist or are in development. The ratio of potential damage from a mine to the cost of building it is huge, making it a very enticing weapon for terrorists and countries looking for a cheap edge. Since the end of World War II, mines have seriously damaged or sunk four times more U.S. Navy ships than all other attacks combined (Figure 3).

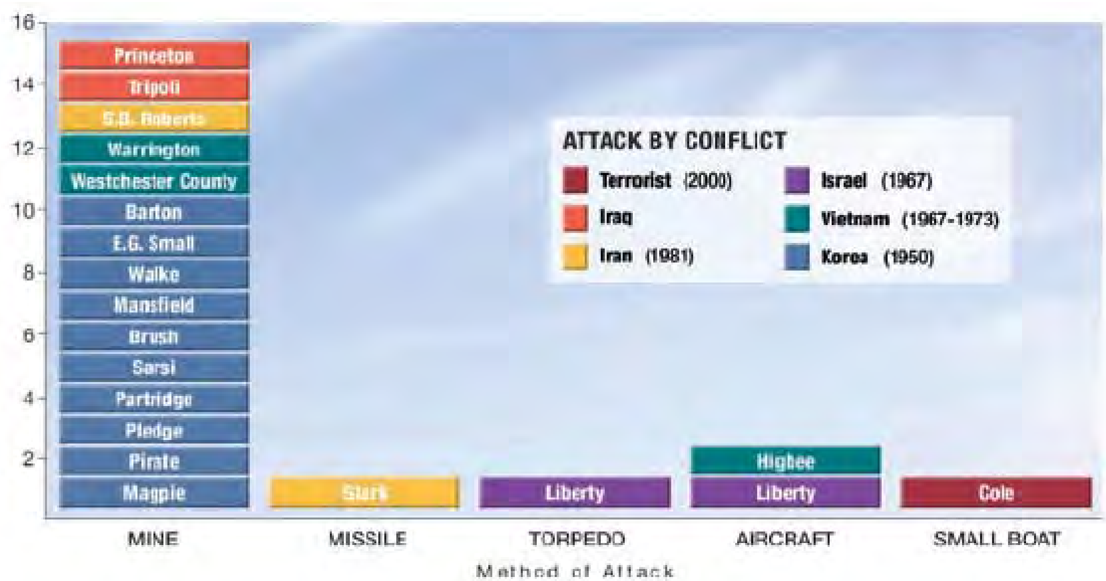

Figure 3. Number of attacks versus method of attack for U.S. Navy ships since WWII. From [3].

Mines and WBIEDs can be configured in a variety of ways, but there are essentially four types: bottom mines, buoyant moored mines, drifting mines, and limpet mines. They are normally placed by aircraft, surface ships, or submarines but can also be placed by pleasure craft, divers, merchant ships or even a person on the pier. They are designed to operate in regions as shallow as the surf zone or as deep as over 200 feet (Figure 4).

Bottom mines are mines that rest on the seafloor and are normally fixed by their own weight. They can also be buried to complicate hunting them. Bottom mines can be placed in shallow water to target surface vessels or deep water to target submarines. The MBES is used to predict the percentage of burial for this type of mine. Buoyant moored mines are constructed in floating cases and fixed by either a mooring or an anchor. Three subtypes of buoyant moored mines are close-tethered mines near the sea floor, in-volume mines, and near-surface mines. Generally moored mines require more volume for air, which leaves less space for explosives and makes them less powerful than bottom mines.

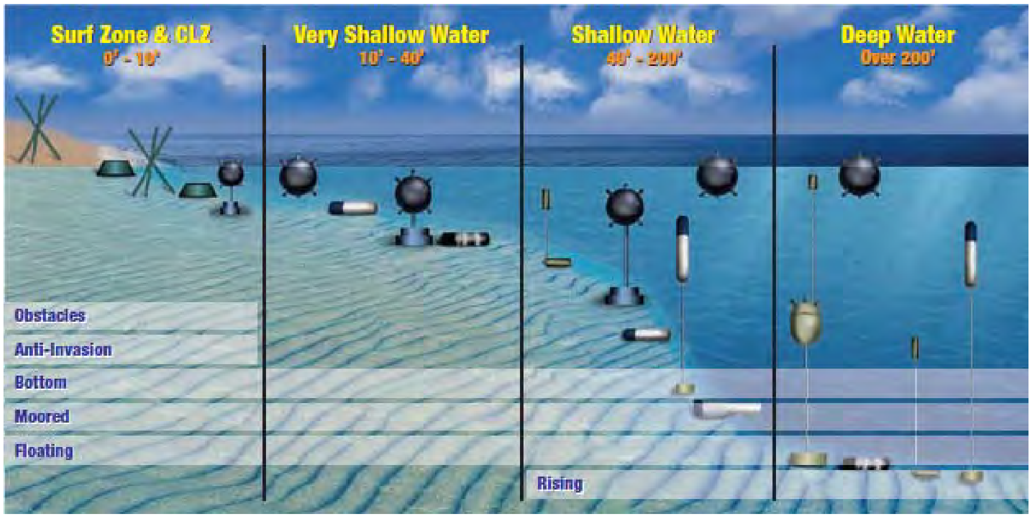

Figure 4. Mine Warfare Regions. From [3].

Drifting mines can either be positively buoyant or neutrally buoyant and are mobile in that they are carried by tides and currents. A variant of drifting mines are oscillating mines, which drift beneath the surface and float between two set depths. International law requires that all drifting mines be inert within one hour of their release from anchor, but they are still used by those who do not honor the law. Lastly, limpet

mines can be attached directly onto the hull of the ship or target vessel and set to explode at any time. Many of the anti-terrorism force protection exercises practiced by surface forces are designed to counter limpet mine threats. Another mine-like weapon falls somewhere between a mine and a torpedo and is sometimes called a mobile mine. With the advancements in UUVs, mobile mines seem more realistic as a viable option in many theaters. With both UUVs and mobile mines, there is a constant balance between power requirements and payload. If future developments bring significant strides in energy density and power management, mobile mines could become much more prominent.

All four mine types can be actuated by a variety of methods. Three common types of actuation are physical contact, influence, and remote or command-detonated. Contact mines are normally either moored buoyant mines or drifting mines. They are the oldest type of actuation but can still be found in mine inventories. Most contact mines use "horns" that protrude from the mine and cause an explosion upon contact. The second type of actuation is influence. This type is also commonly found in moored mines or drifting mines, but this type is much more sophisticated than contact mines. The influence that actuates the mine could be magnetic, acoustic, pressure, chemical, seismic, electrical potential, or a combination of them. Highly advanced versions even have microcomputers that add time delays, smart actuation, and discriminatory behaviors. The third type is remote actuated mines. This type was common in the American Civil War, when the south used command-detonated mines to protect their harbors. The mine fields are monitored by personnel on the shore and detonated upon signal from a command station.

The missions of U.S. MIW forces are supportive of the six core competencies of all U.S. Maritime Forces, and listed in the *Cooperative Strategy for 21st Century Seapower.* These core competencies are: (1) forward presence, (2) deterrence, (3) sea control, (4) power projection, (5) maritime security, and (6) humanitarian assistance and disaster response. Mine warfare is a key contributor to many of these competencies. In order to make a valid contribution though, all of the pieces that make up U.S. Navy need to be fully functional and fully funded. At this time, they are not.

Mine Warfare is comprised of mining capabilities and mine countermeasures. The U.S. Navy has a very dated inventory of mines and seemingly no intentions to update it. There are indications that submarine launched mines are also becoming a thing of the past. The other piece of mine warfare is mine countermeasures. MCM forces are comprised of air, surface, and submarine assets along with divers and sea mammals. A very useful change has taken place recently, when all of the surface MCM ships were moved from Ingleside, TX to operating bases closer to the locations where they would be needed. All surface MCM assets are now split up between two forward operating bases and one base in the continental U.S. Four MCM ships are in Sasebo, Japan, four are in Manama, Bahrain, and six are in San Diego, CA. These ships are all from the Avenger class of MCM ships, which are 224 feet long and have a hull made of fiberglass and wood. The MCM class has had its strengths and weaknesses, but is now between 17 and 24 years old. MCM air assets have been an invaluable asset to the U.S. Navy for over 40 years. Perhaps the most effective aircraft has been the MH-53E helicopter, which was placed in operation in June of 1986. It can operate from small surface vessels and aircraft carriers and it capable of carrying large minesweeping apperati such as the Mk 105 magnetic minesweeping sled, the AQS-14A side-scan sonar, and the Mk 103 mechanical minesweeping system. Unfortunately this aircraft is also toward the end of its life cycle.

Although U.S. mine countermeasures have not completely fallen off of the scope, the Littoral Combat Ship is almost the only sign of hope for the future of surface MCM. Its MCM mission package will help bridge a gap in MCM shortages in the next ten to fifteen years, but the package is still not completed. Once complete it will need to have the ability to detect, classify, and neutralize to really become the asset it is needed to be. As for MCM aircraft, the current and future modifications of the SH-60 will be required to carry the burden as the primary air asset for MIW. This may be a challenge due to the various missions already assigned to the SH-60 and its limited payload capability. Between the number of U.S. Navy MCM assets decreasing and the number of advanced mines and WBIEDs increasing, there will be a tipping point in the near future. Even with current budget constraints, there are research and development opportunities that can still

be leveraged. A shift of focus may be all that is needed for MCM to stay alive and remain a viable option for commanders. The mine warfare cycle of interest and disinterest must be broken before it becomes a lesson never learned in history.

III. MINE BURIAL PREDICTION

A. IMPACT BURIAL

For MCM operations, the seafloor is characterized by its sediment type, bottom roughness, and impact burial. These parameters are then summarized into a doctrinal bottom type used in MEDAL, which has a significant impact on resources required and decisions made about the mine danger area. The bottom types available are A1-A3, B1-B3, C1-C3, and D1-D2. "A type" bottoms are generally sandy and flat, where a C type bottom could be clay and have a large amount of clutter. Impact burial has been studied and modeled extensively, especially for softer sediments where impact burial is more significant.

The development of the Impact Burial Prediction Model (IBPM) by Arnone and Bowen in the late 1970s set the stage for mine burial prediction over the past 30 years. The IB model was a one dimensional model used to predict the vertical position of a cylindrical mine's center of mass as it falls through the three phases (air, water, and sediment). The burial of the mine in the seafloor is then calculated from the sediment characteristics and the mine's velocity. The first generation IBPM only solves the vertical momentum equation and it assumes that the orientation of the mine remains unchanged as it passes through the water. Even with such a large assumption, the IBPM still provided some very useful results. It showed that a mine has a higher falling velocity for a vertical release than a horizontal release. It also showed that the water impact velocity varies greatly with attitude for light mines but not for heavy mines. Lastly, it showed that the mine falling velocity in the water phase of the drop is sensitive to attitude, wet weight of the mine, mine length, and mine radius [8].

To overcome the major assumption in the one dimensional models, Hurst developed two dimensional models that allowed the mine to move vertically and horizontally, as well as rotate about the y axis. The first of these second generation impact models was IMPACT25 and was written in the computer language Basic. IMPACT25 or the IB model was evaluated during a Mine Impact Burial Prediction

Experiment (MIBEX) at Monterey Bay in May of 2000 [9]. During the experiment, the mine track and mine burial depth were visually tracked and correlated with gravity cores of the sediment. Sediment shear strength data sets were obtained from the gravity cores and used, along with the burial depth to evaluate IMPACT25. From seventeen drops the MIBEX showed that two dimensional IB model consistently over-predicted the mine impact burial by at least an order of magnitude. IMPACT28 is the other two dimensional model and was written in MATLAB code. Both IMPACT25 and IMPACT28 contain two momentum equations (in the x- and z-directions) and one moment-of-momentum equation (in the y-direction). They include Mulhearn's formulation for sediment bearing strength and use multilayered sediments. Although they improve the knowledge of mine movement in two dimensions and rotation in one direction, they are still unable to account for the motion of the fluid. This is because of problems associated with assuming the fluid in all three phases move strictly in the (x,z) plane. Any fluid motion in the y-direction induces drag force and causes mine movement also in the y-direction. This mine movement is not accounted for in the two dimensional models. With its strengths and weaknesses, the IMPACT28 model became the starting point for the impact burial prediction capabilities inside the MBES. A variety of third generation models have been developed that are being evaluated by Johns Hopkins University and may be incorporated into the MBES in the future. These models include MINE6D from Yue, Kim, and Liu, a predictive model from Aubeny and Shi, and another 6 degree of freedom model called IMPACT35 from Chu [8].

The three dimensional model IMPACT35 was developed at the Naval Postgraduate School [10] and aimed to overcome the weaknesses of the two dimensional models, i.e., (a) environmental fluid assumed motionless, (b) similar drag coefficients in the axial and cross directions, and (c) unrealistic sediment dynamics. The IMPACT35 model contains three momentum equations and three moment-of-momentum equations and allows the cylinder to move in three dimensional space. This third generation of impact models was verified and improved using a sediment bearing factor method [11]. The model contains three scalar momentum equations,

$$m\frac{d\mathbf{u}}{dt} = \left(\rho\Pi - m\right)g\mathbf{k} + \mathbf{F}_d + \mathbf{F}_l, \tag{3.1}$$

and three scalar moment of momentum equations,

$$\mathbf{J} \cdot \frac{d\boldsymbol{\omega}}{dt} = \mathbf{M}_b + \mathbf{M}_d + \mathbf{M}_l. \tag{3.2}$$

Here, (m, Π) are mass and volume of the mine; g is the gravitational acceleration; ρ is the sea-water density; ($\mathbf{F}_d$, $\mathbf{F}_l$) are the drag and lift forces; **J** is the gyration tensor; **u** is mine's translation velocity; $\boldsymbol{\omega}$ is the mine's angular velocity vector; ($\mathbf{M}_b$, M_d, M_l) are buoyancy, drag, and lift torques. The model predicts the trajectory and burial depth relatively well for cylindrical, near-cylindrical mines, and operational mines such as Manta and Rockan Mines. It is the most complex and robust model available for impact burial prediction and culminates over 30 years of research.

B. SCOUR BURIAL

The work scour is a verb which means to clear, dig, or remove by or as if by a powerful current of water [13]. This is the appropriate use of the word with regards to scour or subsequent mine burial. High velocity water around a mine increases the shear stress at the sediment interface and promotes sediment transport once the shear stress exceeds a critical limit, which is dictated mostly by sediment grain size distribution and cohesion. Scour is also affected by the shape and orientation of the mine [12]. Strong currents around a mine clear away a depression on both sides of the mine, with the greatest evacuation being on the opposite side of the mine from the direction of the current. The mine is stationary while the sediment around it is transported away until eventually the mine rolls into one of the pits created by the surrounding currents (Figure 5). The primary driving forces behind scour burial are tides and wind-driven currents. In order to model scour, these forces must be somewhat well quantified and provided to the model to obtain realistic results.

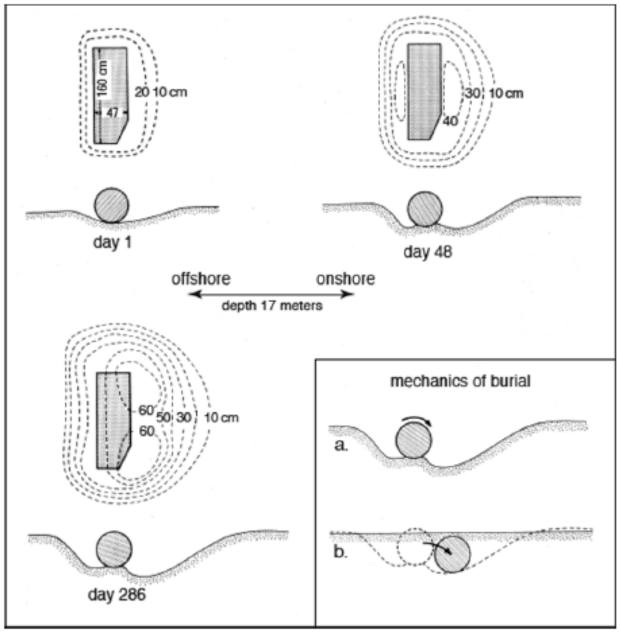

Figure 5. Illustration of steps leading to scour burial of a mine shape.

The U.S. Navy developed a wave-induced prediction model in the 1960s called WISSP. It was a strictly empirical model and predicted scour burial solely on wave energy, water depth, and grain size. The model was never used for anything more than an indication of whether scour burial would take place in a given scenario. It therefore had no abilities to characterize tides, currents, or a time dependency. The German Navy developed a similar model in the 1980s called Nbury which was based on the same empirical data as WISSP [5]. Nbury improved on WISSP in that it included variables for mine diameter and time dependent mine burial based on significant wave heights and bottom current speed. The next advancement in scour burial predictions came with the development of the Defense Research Agency Mine Burial Environment (DRAMBUIE). It is a model built in the United Kingdom during the 1990s by Whitehouse et al. Although it still used primarily empirical observations based on experiments, it was the closest yet to a completely physics-based model that described scour burial processes. The model included sediment properties, a time series of tides and wave heights, and mine characteristics in its predictions.

C. BURIAL PREDICTION SENSITIVITIES

Burial can generally be predicted from the following: 1) hydrodynamic forcing from wave, tidal, and bottom currents, 2) water depth, 3) sediment properties such as grain size, density or porosity, and shear strength, combined with 4) characteristics of the mine such as size, shape, density, and method of deployment. It is impossible to empirically represent the entire domain of mines, release conditions, and geographic variability. Otherwise, mine burial models could be built directly from existing data. The MBES was developed to capture the variability of model inputs and give the appropriate variability in the output percentage of burial. To accomplish this, the most important factors were analyzed and set up as input PDTs to the MBES network. The current inputs are shear strength, angle of release, mine type, and water depth. These inputs are primarily for prediction of impact burial. Future use of the MBES for scour burial may include inputs such as tidal amplitude, wave height, wave period, sediment grain size, and duration.

1. Sensitivities of Impact Burial Prediction

Previous sensitivity studies [9] have shown that the most important factor controlling the amount of impact burial is the resistance of the sediment on the seafloor to penetration of the mine. The resistance is captured as a parameter referred to as shear strength, a geotechnical parameter that is recorded in a variety of forms and has been measured in a variety of ways. This parameter was not historically found in NAVO databases, but they have assigned shear strength values to the Enhanced Sediments category set for use by the MBES. Shear strength is an appropriate parameter for mine burial predictions because mines normally hit the seafloor at a relatively high velocity (greater than 2 m/s). As a result, the pore water does not have time to escape from the pore spaces in the soil grains. The velocity of the mine also creates variability in burial as a function of shear strength. Figure 6 shows this relationship from data output by the IMPACT28 model. All mines are predicted to be completely buried in very soft

sediments, but velocity plays an important role in sediments with shear strength between 2 and 20 kPa. In this range, a change in velocity of 4 m/s can result in a difference of burial percentage of 20%.

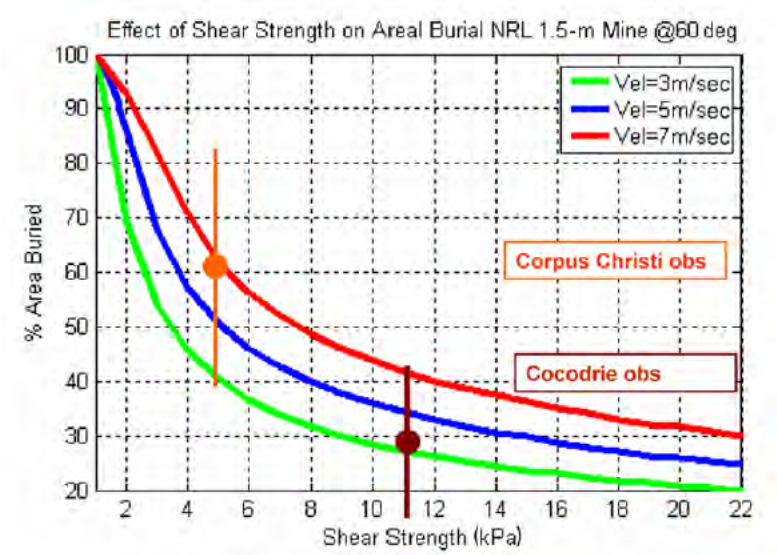

Figure 6. Effect of shear strength and mine velocity on prediction for area burial. Overlaid are mean and standard deviation of burial at mean shear strength from two field tests. From [15].

The IMPACT28 model also requires an input parameter to its sediment-penetration portion known as bulk density. The same sensitivity study from Chu et al. states that bulk density has a noticeable effect in shear strengths between 3 and 5 kPa. Because of this small correlation between shear strength and bulk density in very soft sediments, the MBES collapsed them into one input for shear strength. With this approach, bulk density only has an effect on burial at shear strength values less than 6 kPa.

The second input to the MBES is angle of release. Accurate prediction of the angle of release of the mine is vital because it influences the velocity and determines the orientation of the mine upon impact. These processes are captured in two intermediate nodes of the MBES named “Sediment Impact Angle” and “Sediment Impact Velocity.” Studies of mine trajectories that led to the development of IMPACT28 described the behavior during descent as extremely complex and at times chaotic. The geometry of the

mine as it falls through the water column is subject to a variety of influences that are very difficult to model. The MBES does not account for these complex trajectories, but instead uses simple physics of a cylindrical mine shape to capture variability in the release angle. Strangely enough impact angle does not have a significant effect on burial, except for mines with a near vertical impact.

The last two inputs for impact burial are depth and mine type. Water depth is important to modeling both impact and scour burial because it affects the impact angle and velocity. This is somewhat expected because orbital velocities decrease exponentially as the mine descends to the seafloor. It is not necessarily the depth that affects these parameters but the amount of time it takes for the mine to fall from release to impact. The depth domain of interest for the MBES is 6 to 40 meters, which covers most navigation channels and the shallow coastal region beyond the surf zone. Inputs for mine type have changed from 3 mines to 4 mines and will be discussed in detail in chapter IV.

2. Sensitivities of Scour Burial Prediction

Prediction of scour burial is becoming more and more important and our ability to model scour has increased significantly. Areas such as marine engineering have had increased interest as well because of the existence of bridges, platforms, and seafloor pipes and their susceptibility to scour. The majority of scour models require a time series of near bottom currents, surface gravity wave spectra, sediment grain size and bulk density, seafloor morphology, and mine characteristics as inputs to the model.

Years of field experiments and modeling indicate that the most important factor controlling scour burial is the magnitude of near-bed velocity, which is largely a function of wave height and period. Models have shown that a difference of one meter in significant wave height can separate no burial and complete burial. The local water depth has an important role in these processes though. Much of the scour burial observed at different wave heights did not begin to take place at a fixed depth until the waves reached a specific height relative to the bottom. This is particularly interesting because it seems that most of the burial due to scour is a result of significant weather events.

As previously mentioned, scour burial is mostly prominent in sediments with a larger grain size, such as sand. This is an unsafe generalization though because of effects such as ripples and armoring. A sand ripple field has shown to inhibit burial once the height of the mine is approximately 1.3 times the height (peak to trough) of the ripples. In sediment distributions that change from sand to gravel, the sand is transported but gravel remains and creates an armoring effect. This effect also inhibits burial and must be accounted for when modeling in these sediment conditions.

Accurate modeling of scour burial must also include tidal influences. For the MBES, the dominant M2 tidal constituent with period 12.42 hours was used. The tidal current amplitude specified was the speed at maximum flood or ebb averaged with depth. With this setup, scour occurs during peak flows of tidal current and shows slack periods of no scour burial in between the peaks. Because of the sensitivity of these processes, the input for tidal amplitude must be highly accurate.

IV. MINE BURIAL EXPERT SYSTEM

A. EXPERT SYSTEM APPROACH

An expert system provides an integrated approach for organizing current knowledge of experts in a particular field of work and setting it into an operational prediction system. For the MBES, the expert knowledge is contained in physics-based models and observational data, while model error data are quantified by comparison to available data. The stochastic framework of the expert system carries forth environmental and model uncertainties and creates a method for synthesizing research into a form that provides burial predictions that include the uncertainties. The output of the MBES is a percentage of mine burial presented as a probability distribution, with a mean burial and uncertainty quantified as the standard deviation of the mean. This prediction is an appropriate tool for MCM Commanders to make the plans and decisions necessary for the success of their missions.

Expert systems fall under the general class of artificial intelligence, combining domain-specific knowledge with a reasoning or inference algorithm [17]. For the MBES, the domain knowledge base is data from years of mine burial experiments, physics-based models that are built to replicate the data, and the expertise of academia and the U.S. Navy. The expert system uses a decision structure of rules operating on the domain parameters; this includes environmental and operational parameters for mine burial. The decision structure for the MBES is a Bayesian network and the rules are described by conditional probability distributions.

A Bayesian network represents relationships among key parameters as connections between “nodes” that represent the variable parameters. The connections between nodes represent knowledge about the amount of influence a given variable has on another. The network makes computations very efficient because simultaneous calculations occur only between nodes with a causal dependency. Separate calculations then only have to occur for the unconnected nodes, but are also simplified using the assumption of conditional independence. Bayesian networks were originally developed

to handle uncertainty in a quantitative manner. They are statistical models where the nodes represent random variables and the connections represent conditional dependence. There are two fundamental equations for this stochastic reasoning; one is the sum rule

$$P(A) + P(\widehat{A}) = 1 \qquad (4.1)$$

where A is the specified hypothesis, $P(A)$ is the probability of A being true, $\widehat{A}$ is the complement of A, and $P(\widehat{A})$ is the probability of A being false. The rule also states that $P(A)$ must sum to 1 for all values of A. The second rule is the product rule

$$P(A \cap B) = P(B \middle| A) \times P(A) \qquad (4.2)$$

where B is a second hypothesis, $P(A \cap B)$ is the joint distribution of A and B or the probability that both A and B are true, and $P(B | A)$ is the conditional probability that B is true given A is also true. For the MBES, these rules are applied to a forward prediction problem of estimating mine burial given specific parameter with uncertainty. The causal probabilities follow an important principle called the marginalization principle. This allows the derivation of probabilities that can be recycled in the network given initial probabilities. Imagine that you have A_1, $A_2, \ldots . A_n$ and C_1, $C_2, \ldots . C_n$ as possible explanations for B_k. Given that A_i and C_j are exhaustive and mutually exclusive properties within their sets, then the marginalization principle states that

$$P(B_k) = \sum_i \sum_j P(B_k A_i, C_j) P(A_i) P(C_j). \qquad (4.3)$$

This shows the probability of B being in state k is only obtained by looking at all possible explanations for B_k. The principle also organizes how the probabilities of hypotheses are used when making predictions based upon them. Within the Bayesian network, variability is quantified by computing the relative probabilities of all relevant hypotheses or explanations.

B. CAPABILITIES AND LIMITATIONS OF MBES

The primary purpose of the MBES is to provide a state-of-the-art mine burial prediction capability to the U.S. Navy. As mentioned previously, this is accomplished by combining decades of impact and scour modeling successes with the knowledge and experience of known experts. These capabilities are merged by the Bayesian network burial prediction expert system. For the MBES, Bayesian networks were implemented using the Netica commercial software package [16]. This software was ideal for creating the user interface needed for the nodes and connections that make up the network of the MBES. To be made suitable for the MBES the input distributions of the network were discretized into Conditional Probability Tables (CPTs). Some of the inputs are naturally discrete, such as mine type, while variables like shear strength were discretized for optimal use in the MBES. The input CPTs were chosen based on the sensitivities and parameters discussed in Chapter III. The resolution of each input CPT depends on a tradeoff between resolving the important parameters and avoiding over-specification of unknown or irrelevant data. Figure 7 shows the relationships between nodes and links of the impact burial portion of the MBES. The relationships were taken from existing dependencies in the IMPACT28 model and supplemented by insights from experts in impact burial processes. Additionally, the relationships were given their stochastic characteristics by Monte Carlo runs of the IMPACT28 model, which created the causal dependency in the expert system. All of the nodes of the network lead to an area fraction buried. This describes the fraction of the mine’s surface area that was buried upon impact or after a certain amount of time. Input CPTs with little variability will normally result in a burial prediction with relatively little variability. The final output of the expert system is a probability density table (PDT) representing percentage of mine burial. This output can be interpreted either as the probability that a single mine will be buried a certain amount or that within a field of mines, a certain percentage of them will be buried. The interpretation of the output depends on the underlying interpretation of the inputs.

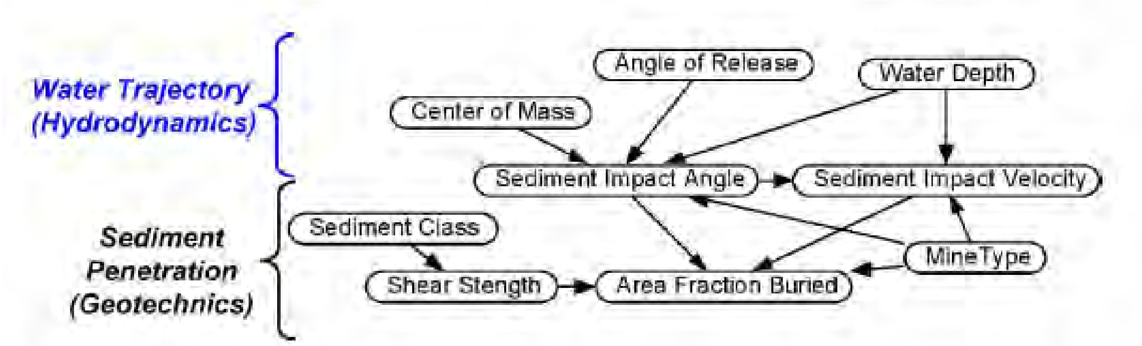

Figure 7. Network diagram showing relationship between variables in the impact burial portion of the MBES. From [17].

The MBES has been validated using the IMPACT28 model and a series of laboratory and field experiments [18] [19] [20] [21]. The IMPACT28 model was able to predict the mean burial in most cases within a few percent but had difficulty capturing the complex behavior of the cylinders. As stated previously, the model does over-predict burial in many cases. Because the IMPACT28 model is purely deterministic, the variability of the predictions could not be used. This is where the MBES was able to improve on the prediction capability of previous models. The variability of the deterministic models was quantified as additional uncertainty in the Bayesian network of the MBES. As hydrodynamic and sediment-penetration models improve, the inputs to the MBES will have less variability. Again, this will result in a more certain output distribution for percentage of burial.

During the transition of the MBES from JHU-APL to NAVO, the Bayesian network underwent several changes to meet the needs of the end user. The original design of the impact burial network included input CPTs for sediment shear strength, water depth, mine type, angle of release, and center of mass. It had intermediate nodes for sediment impact angle and sediment impact velocity and the output distribution for percentage of mine burial. The relationships of the original network setup can be seen in Figure 8.

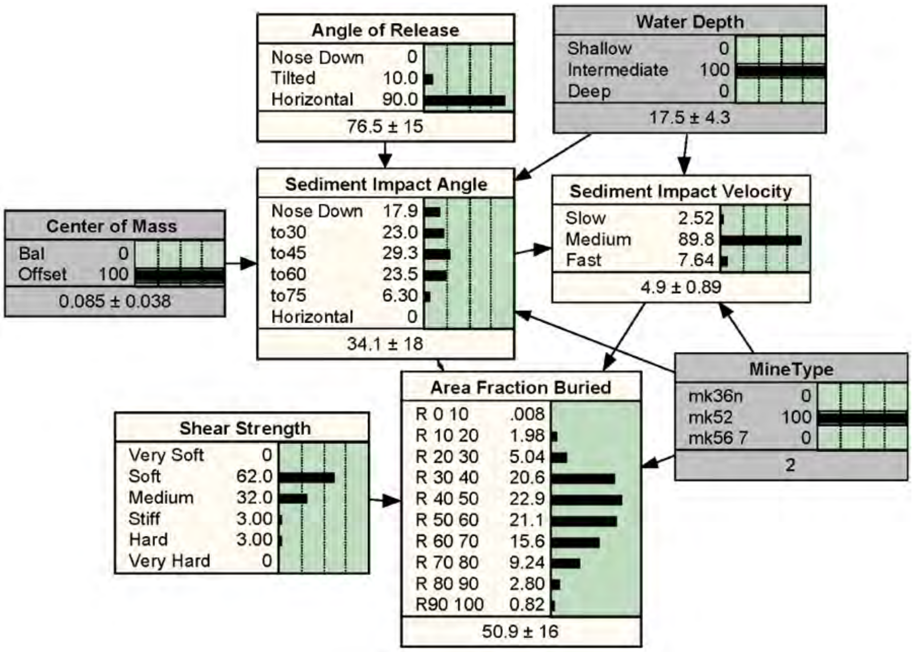

Figure 8. Original Bayesian network setup for the MBES. From [15].

The design of the network was modified by engineers at the NRL in order for the MBES to be integrated with the EPMA tool at the Mine Warfare Department of NAVO. The first structural change that took place was the merging of the mine type node and center of mass node and the addition of one mine type. The original network accounted for a balanced or offset center of mass and three mines. The range of offset for center of mass was 0–10% and the specifications for the three mines used are in Table 1. These inputs were combined for use by NAVO into one input node titled mine type. This node included parameterization of the mine type and center of gravity for four mines (Table 2).

Table 1. Specifications of original MBES mine types. From [15].

Mine Type	Length (m)	Maximum Diameter (m)	Weight in Air (kg)	Density (kg m^{-3})	Wet Weight (kg)	Buoyancy Parameter[a]
Mk36n Destructor (tapered, bomb-shaped)	1.74	0.27	226	2269	122	1.2
Mk55-57 classes	2.4	0.53	1017	1921	468	0.87
Mk52 series	1.5	0.47	544.3	2092	273	1.04

[a]Buoyancy parameter is (mine density - seawater density)/seawater density.

Table 2. Specifications of new mine types in the MBES for NAVO.

Mine type	Length (m)	Maximum diameter (m)	Weight in air (kg)	Center of Gravity offset
BRM (FWG Burial Recording Mine)	1.7	0.47	500	0–1.3%
Stonefish Exercise Mine	1.91	0.52	755	0–5%
NRL MK56 Instrumented Mine	2.4	0.57	1070	3.70%
MK36n Destructor Mine	1.74	0.274	227	0–5%

The second change made to the impact burial network was to the shear strength node. The original node ranged from 0–30 kPa with six discrete bins. These bins represented the rigidity of the sediment and went from very soft to very hard. The modified node for shear strength contained the range of 0–30 kPa over seven bins and an eighth bin for shear strength greater than 70 kPa (Figure 9). The nodes for angle of release and water depth remained unchanged from the original design.

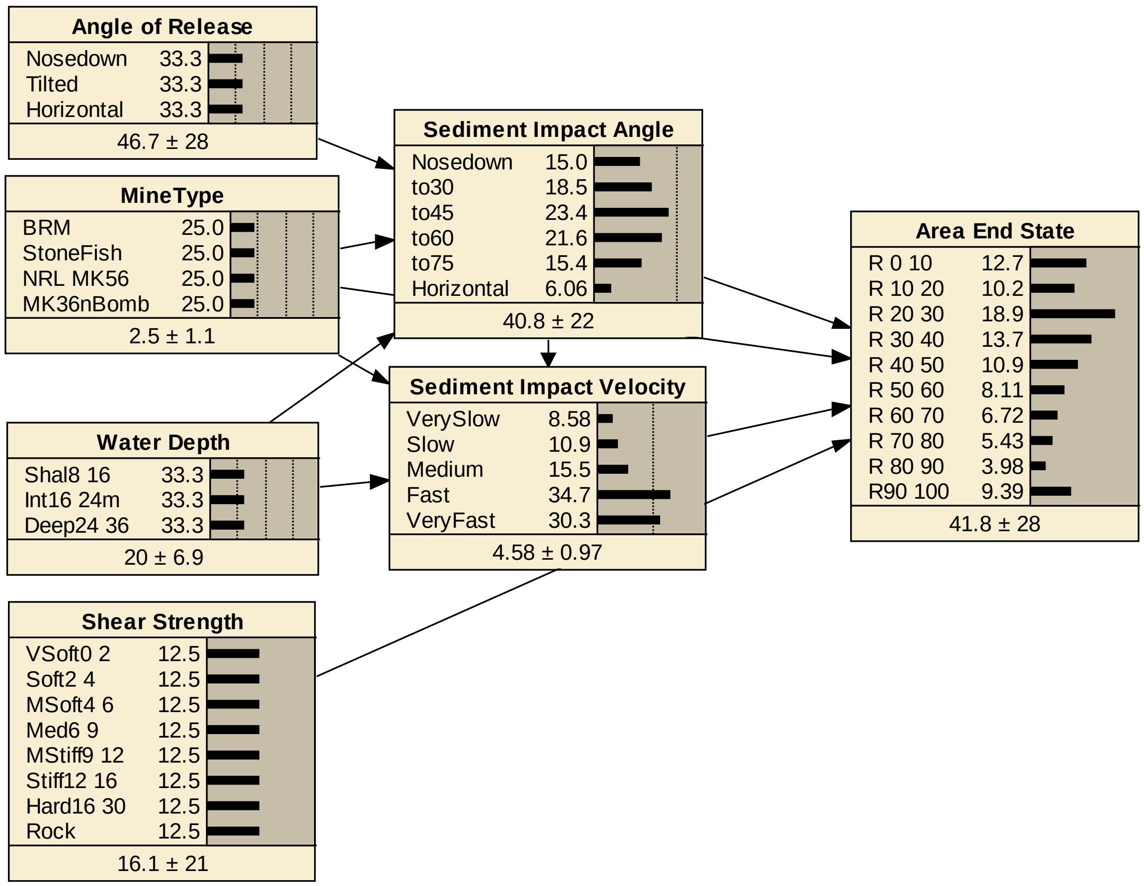

Figure 9. Bayesian network setup for use by MIW Division at NAVO.

THIS PAGE INTENTIONALLY LEFT BLANK

V. BAYESIAN NETWORK

A. METHOD OF ANALYSIS

The goal of this analysis was to qualify a binning scheme for impact burial prediction that is more appropriate than the current doctrinal sediment categories. This was accomplished by running several iterations of the MBES model with Netica and examining the output distributions. As it turns out, any binning scheme different than the 10 bins output from the MBES is not optimal now, and certainly will not be optimal in the future.

In order to run the model, a text file with a .dne file extension was needed. This file, which can be found in the appendix, contains all of the data required to specify inputs, conditional relationships, the output, and all of the algorithms of the Bayesian network. It was provided by Bruce Lin at the NRL and is the same file that he and his team use to build the MBES into the EPMA. It is also designed to be run in the Netica software package. The input distributions that were used to specify sediment shear strength were provided by Paul Elmore at the NRL. They can also be found in the appendix for all of the enhanced sediments contained in the NAVO database.

The original plan was to run the model through a DOS command prompt with a build of the MBES in the EPMA tool provided by Bruce Lin. Using the program to run several different setups and collect the results turned out to be less than optimal. Instead, the Netica software was loaded onto a laptop computer running 32-bit Windows 7 as the operating system. This method was used by Nathaniel Plant among others in the development of the MBES. The software allows its user to open a .dne file from a standard Windows GUI. All of the results in the next two subsections were obtained using this method. The input distributions were altered in the .dne file and the file was saved to an appropriate name, then run through the Netica program.

B. RESULTS FOR UNKNOWN MINE TYPE

Figures 7 through 22 are 16 configurations of the Bayesian network that are available to current users of the EPMA MBES tool. The current EPMA build only allows its user to change depth and sediment shear strength, which are both oceanographic or geological quantities that can be obtained through databases or sampling the environment. Mine type and angle of release are much more difficult to represent without outside intelligence. Three sediments types were used that cover the full scope of common burial distributions: (1) sand, (2) silt, and (3) clay. Each sediment type was analyzed alone, with all other inputs being uniform distributions. Additionally, each sediment type was analyzed at one of three different depths: (1) shallow (8–16 meters), (2) intermediate (16–24 meters), and (3) deep (24–36 meters). A histogram of all 16 scenarios was developed utilizing MATLAB and can be seen in Figure 23.

Table 3 lists the 16 scenarios that are available to current EPMA users. It also shows that the variability of the output distribution decreases slightly as more input parameters are known.

Table 3. Summary of prediction results using common configurations of the Bayesian network.

Figure No.	Scenario	Mean burial (μ)	Standard Deviation (σ)
10	All parameters unknown	41.8	28
11	Shallow depth (8–16 m)	40.8	27
12	Intermediate depth (16–24 m)	41.8	28
13	Deep depth (24–36 m)	42.8	28
14	Sand	27.2	21
15	Silt	44	25
16	Clay	73.2	21
17	Sand SS distribution, Shallow depth	26.5	20
18	Sand SS distribution, Inter. depth	27.1	21
19	Sand SS distribution, Deep depth	28	22
20	Silt SS distribution, Shallow depth	42.7	24
21	Silt SS distribution, Inter. depth	44	25
22	Silt SS distribution, Deep depth	45.2	26
23	Clay SS distribution, Shallow depth	72.3	21
24	Clay SS distribution, Inter. depth	73.5	21
25	Clay SS distribution, Deep depth	74	20

1. Completely Unknown Input Parameters

To set a baseline and establish a solid starting point for the model statistics, a totally unknown scenario was run through the model. All of the input distributions are uniform, implying that nothing is known about the environment, mine type, or deployment method. Of particular interest is the fact that the model takes completely unknown inputs and is able to produce an output distribution that is not uniform. This illustrates the value of the Expert System, with its years of empirical data and experience from the best in the field of impact burial.

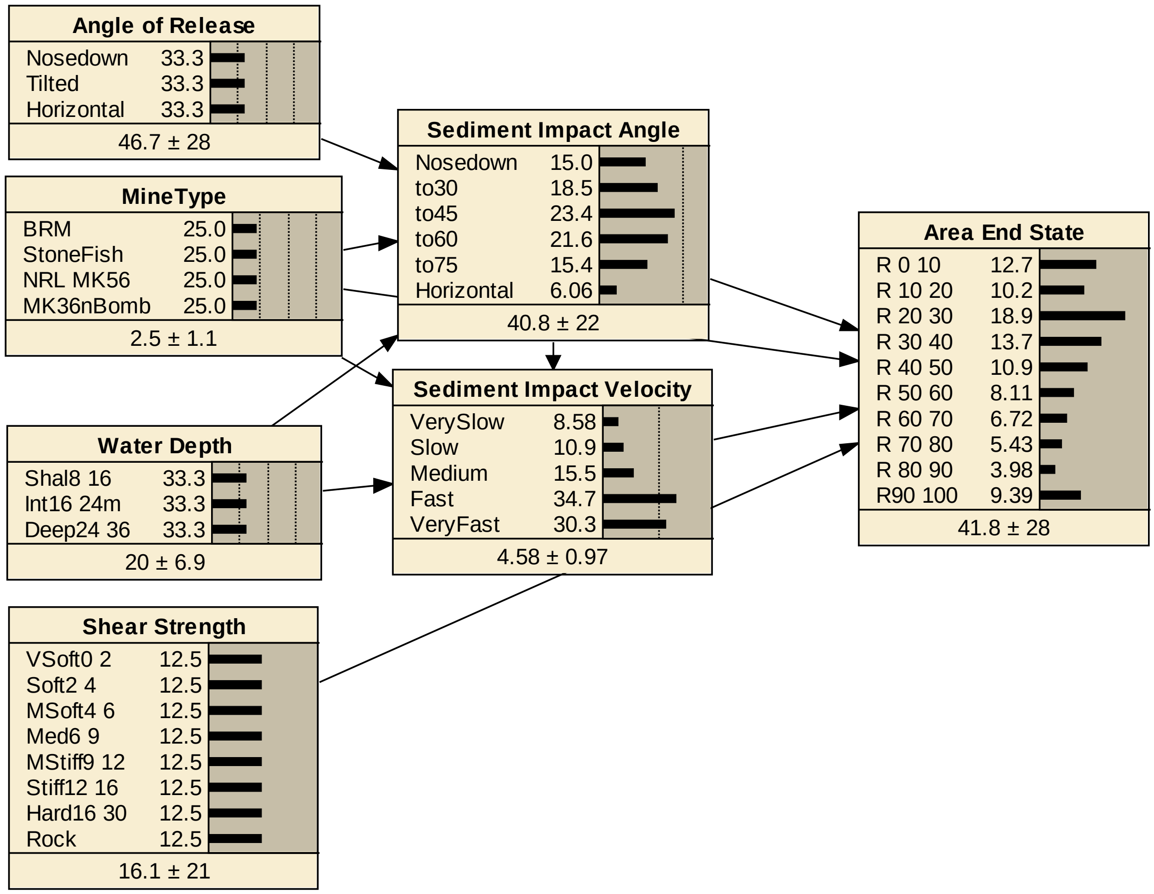

Figure 10. The Bayesian network predicts mean 41.8% burial and 28% standard deviation with the totally uncertain scenario (i.e., uniform input PDFs).

2. Known Water Depth

The next three model runs exercise the MBES for known water depths. The end state mean burial only increases by 1% as the input depth changes from shallow to intermediate and another 1% from intermediate to deep. The variability between shallow and intermediate changes slightly from 27 to 28, but does not change at all from intermediate to deep. From all of the model runs used in this analysis, it appears that knowing the water depth has the smallest effect on the output percentage of burial.

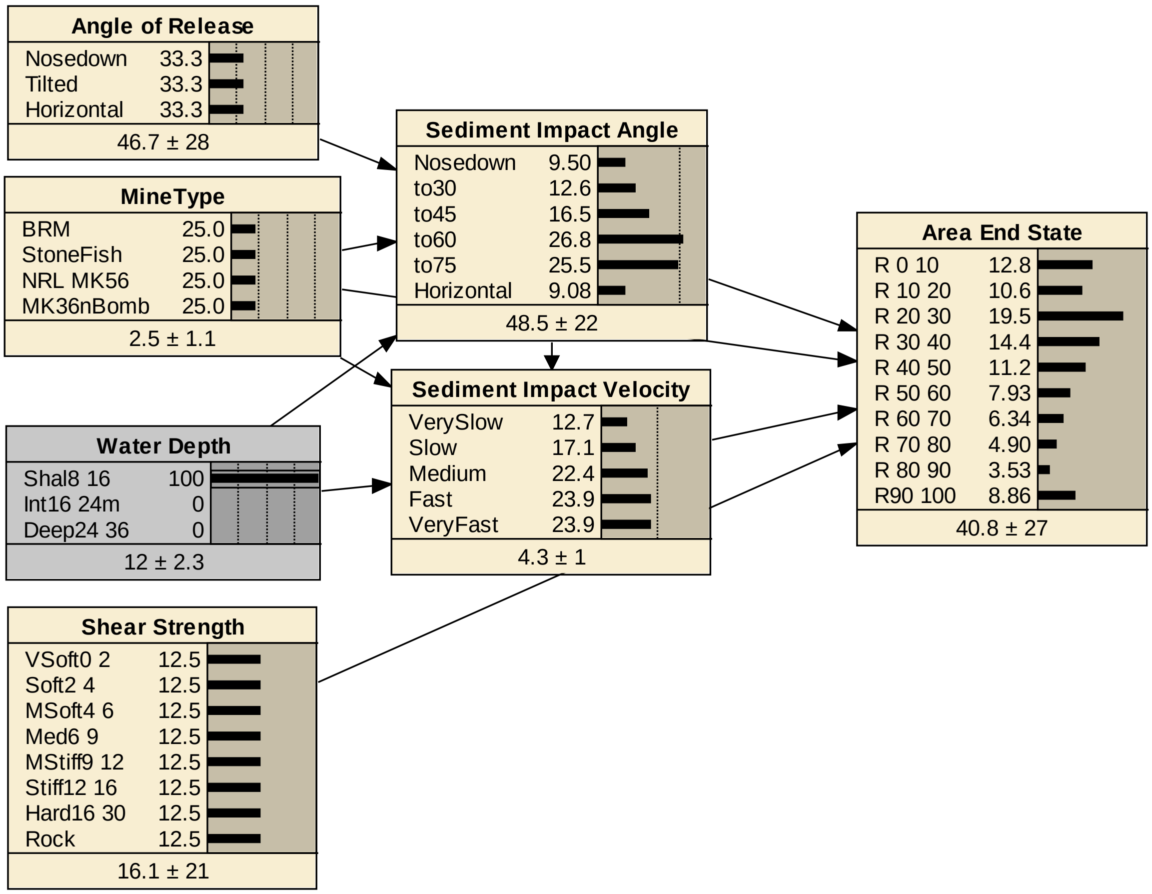

Figure 11. The Bayesian network predicts mean 40.8% burial and 27% standard deviation with the water depth known to be shallow.

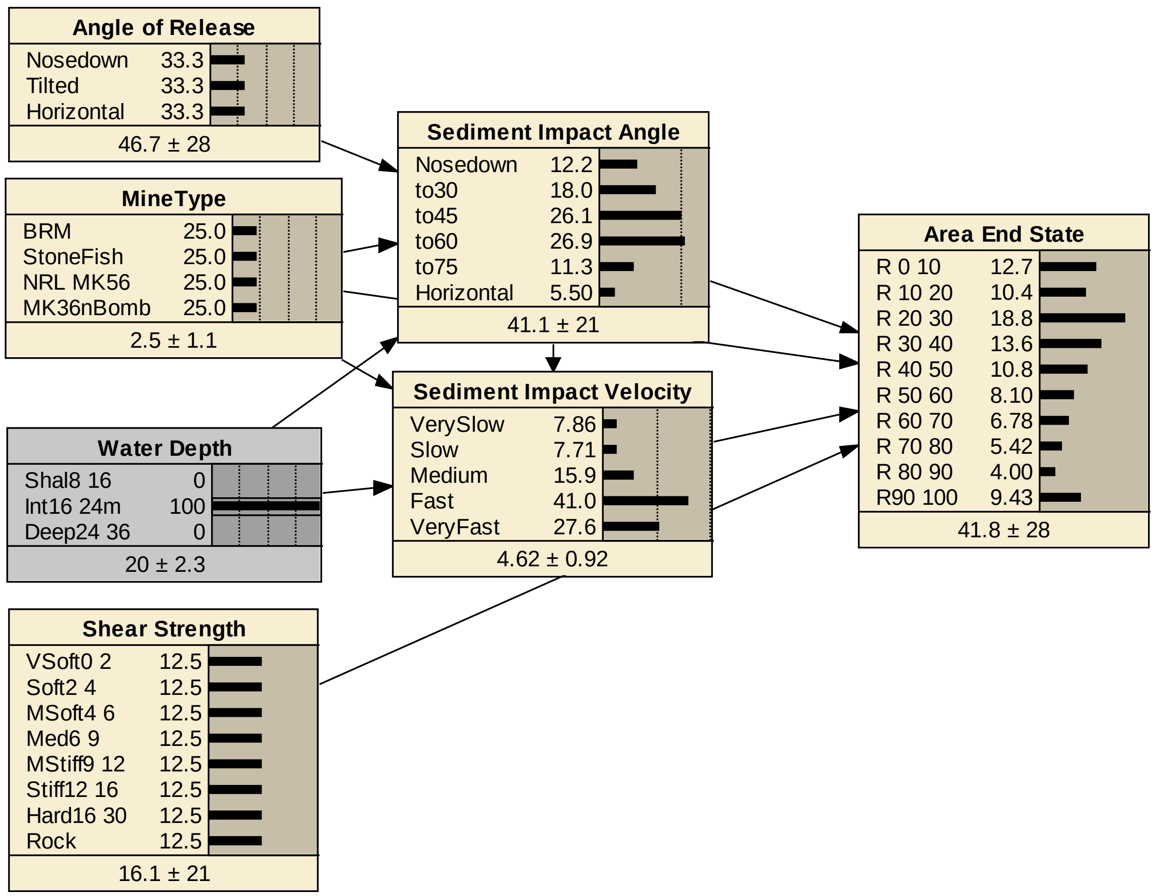

Figure 12. The Bayesian network predicts mean 41.8% burial and 28% standard deviation with the water depth known to be intermediate.

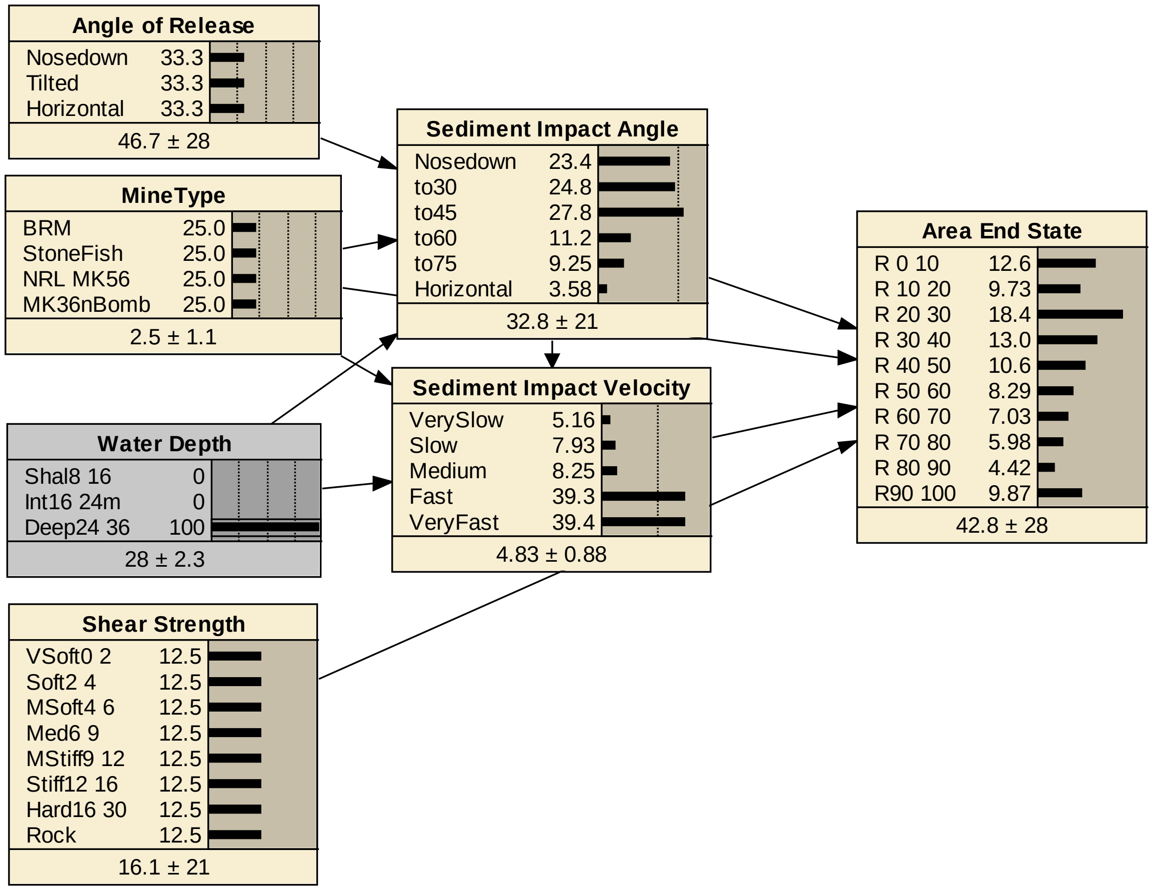

Figure 13. The Bayesian network predicts mean 42.8% burial and 28% standard deviation with the water depth known to be deep.

3. Known Sediment Type

The next three model runs are for a known sediment type. All three sediments have a lognormal shear strength distribution and result in completely different burial estimates. Sand is the most rigid and only shows a mean burial of 27.2%, with more of the distribution in the 0–10% bin than any other. The silt distribution has a mean burial of 44%, but the standard deviation is 25, which is much larger than the other two sediments. Representing the very soft sediments, clay shows a large degree of burial at 73.2%, with most of the output distribution falling in the 90–100% burial bin. As expected, changing the shear strength distribution has the largest effect on the prediction.

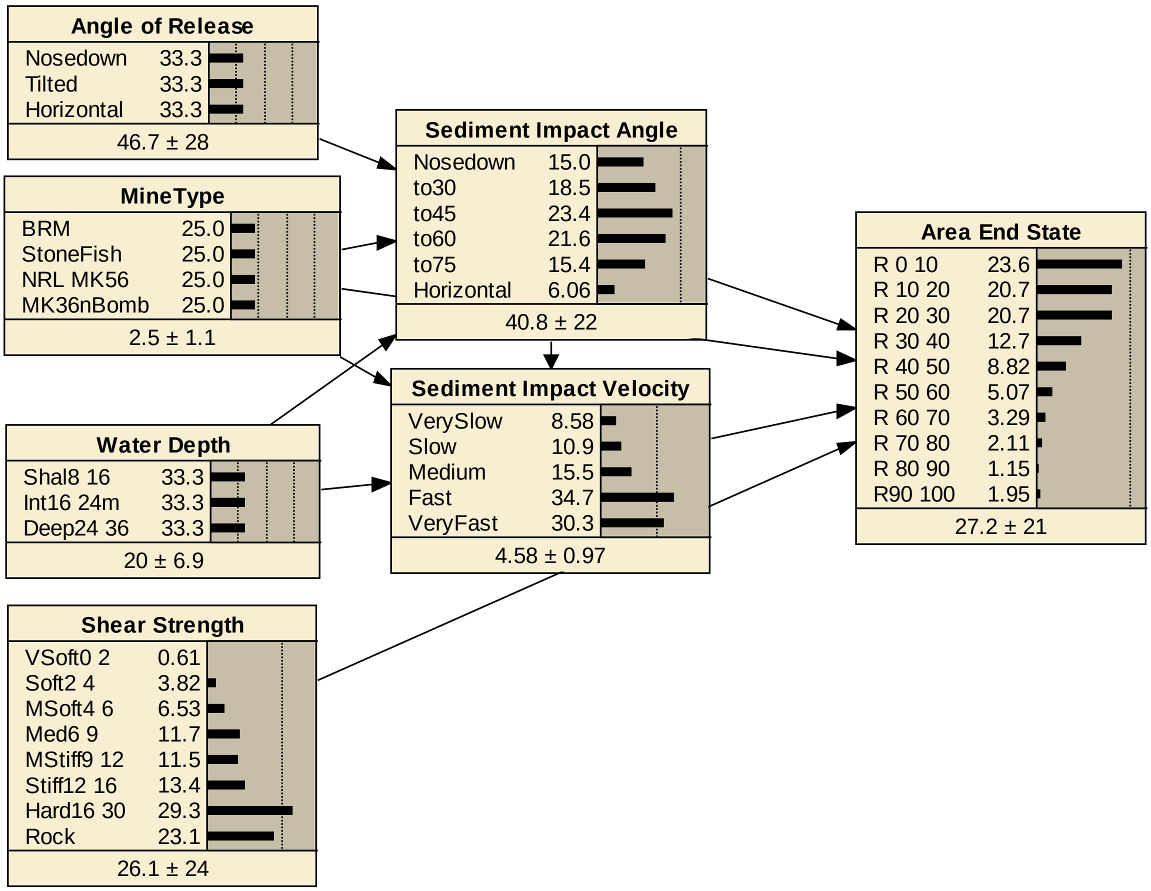

Figure 14. The Bayesian network predicts mean 27.2% burial and 21% standard deviation with the lognormal shear strength distribution of sand.

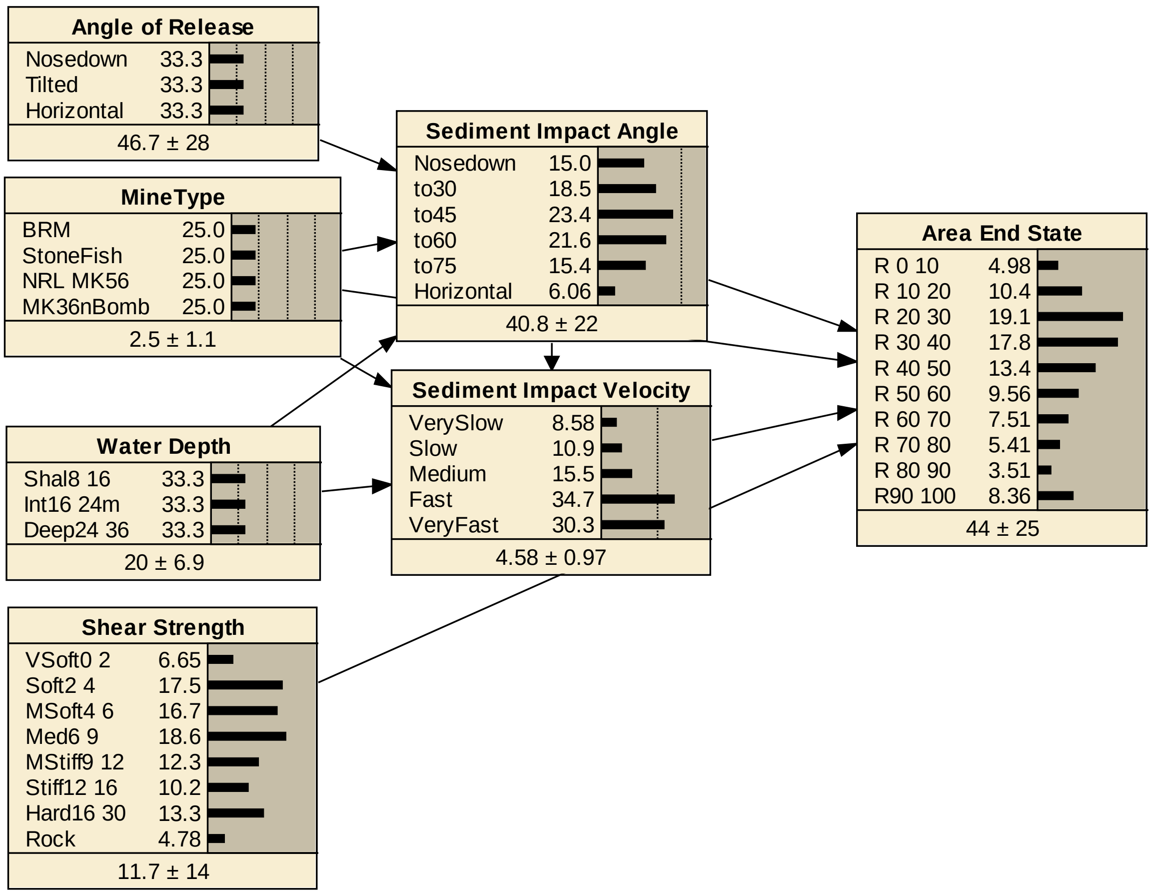

Figure 15. The Bayesian network predicts mean 44% burial and 25% standard deviation with the lognormal shear strength distribution of silt.

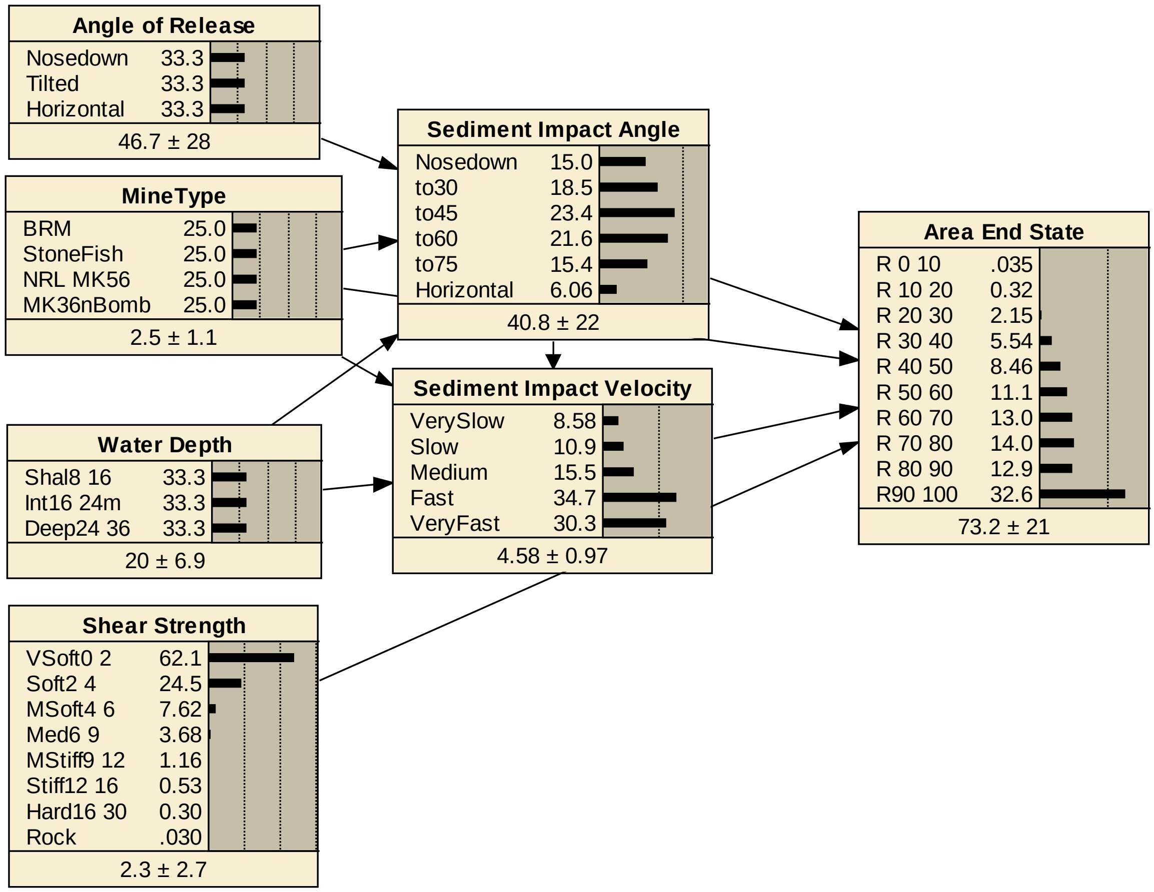

Figure 16. The Bayesian network predicts mean 73.2% burial and 21% standard deviation with the lognormal shear strength distribution of clay.

4. Known Water Depth and Sediment Type

The last useful set of scenarios is to run the MBES with known water depth and sediment shear strength distribution. Each of the three sediment types used prior was run for each possible depth. One interesting observation is that for sand and silt the variability increased with depth, but the same did not occur for clay. Again, changing the depth for each sediment type only had a minor impact on the percentage of burial.

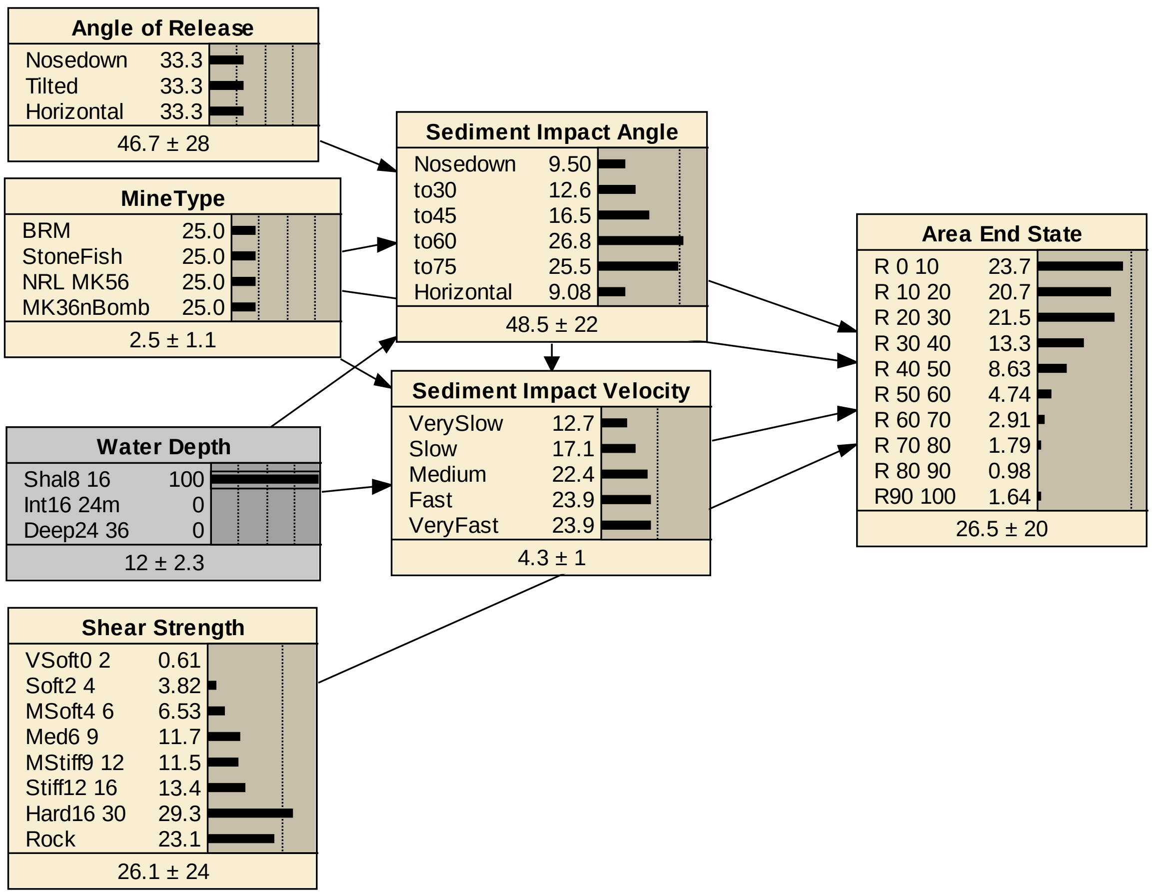

Figure 17. The Bayesian network predicts mean 26.5% burial and 20% standard deviation with two known inputs; water depth is shallow and sediment type is sand.

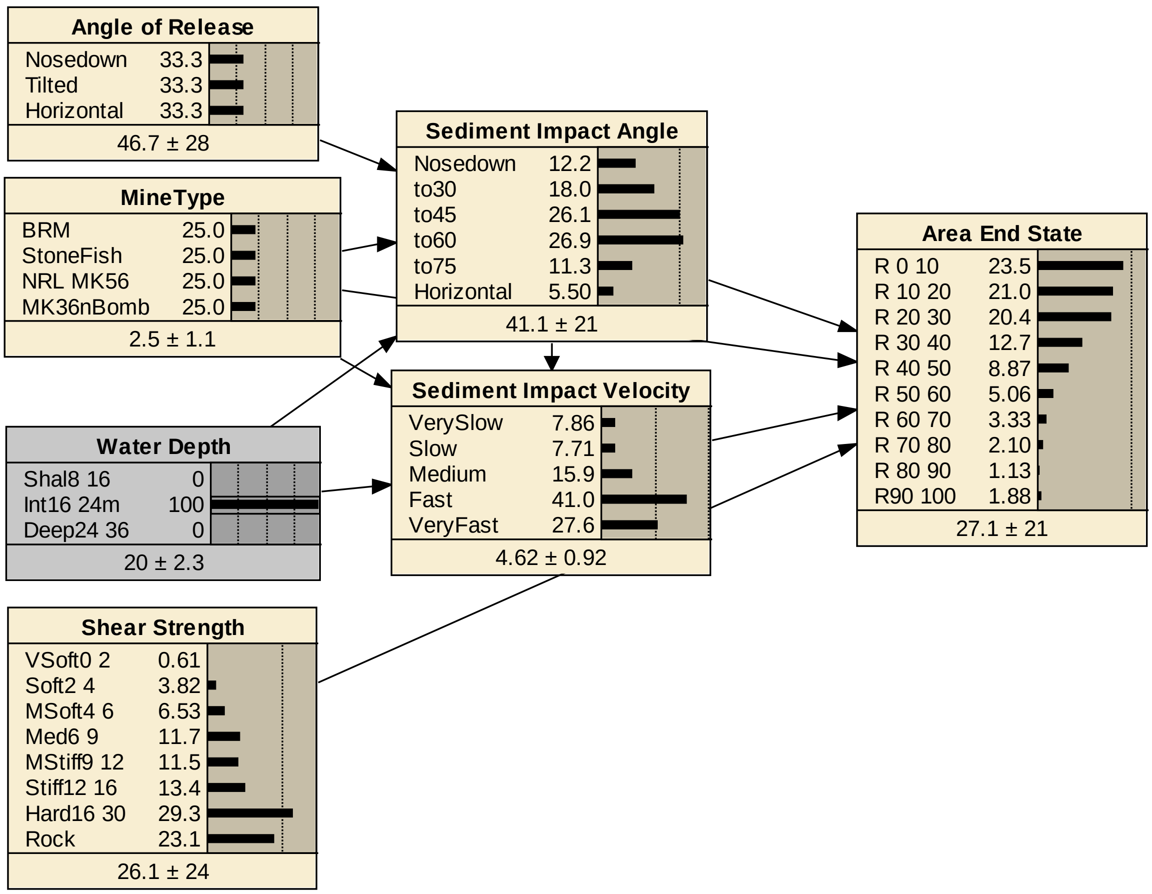

Figure 18. The Bayesian network predicts mean 27.1% burial and 21% standard deviation with two known inputs; water depth is intermediate and sediment type is sand.

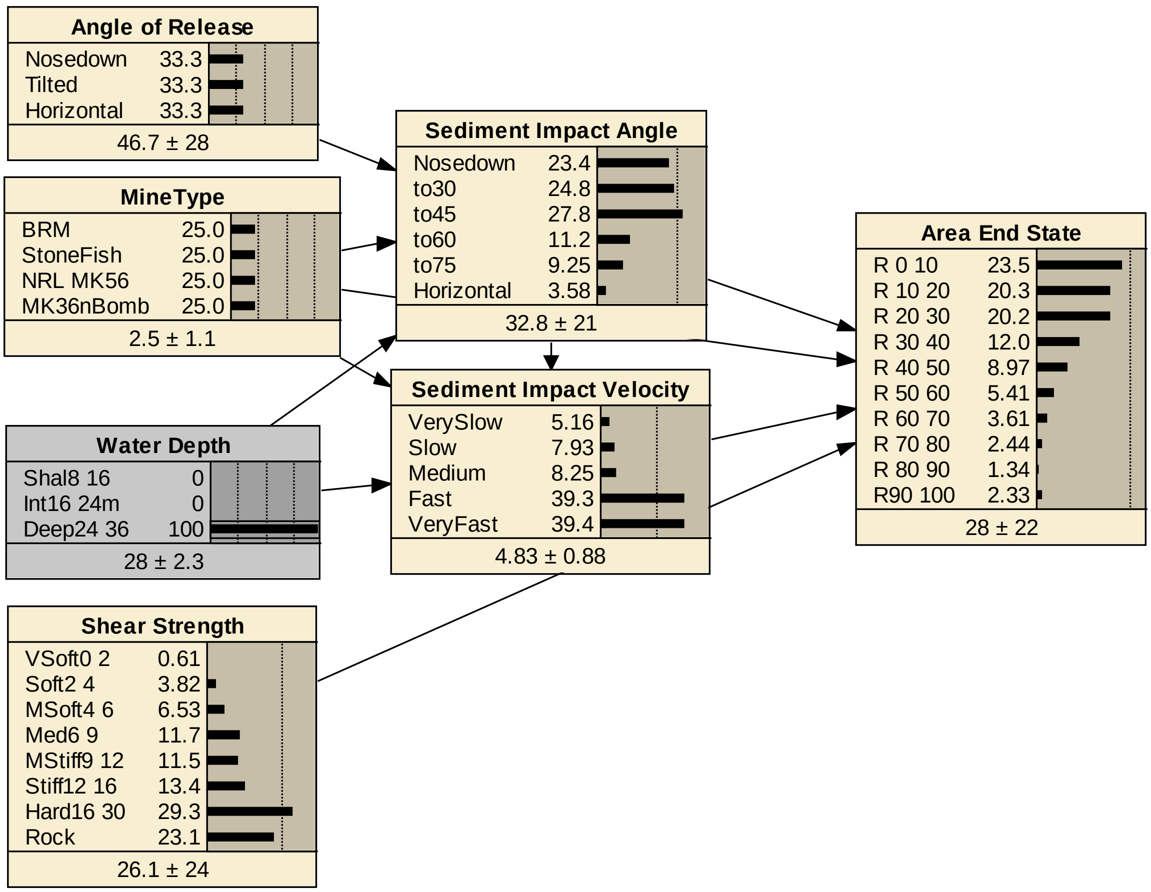

Figure 19. The Bayesian network predicts mean 28% burial and 22% standard deviation with two known inputs; water depth is deep and sediment type is sand.

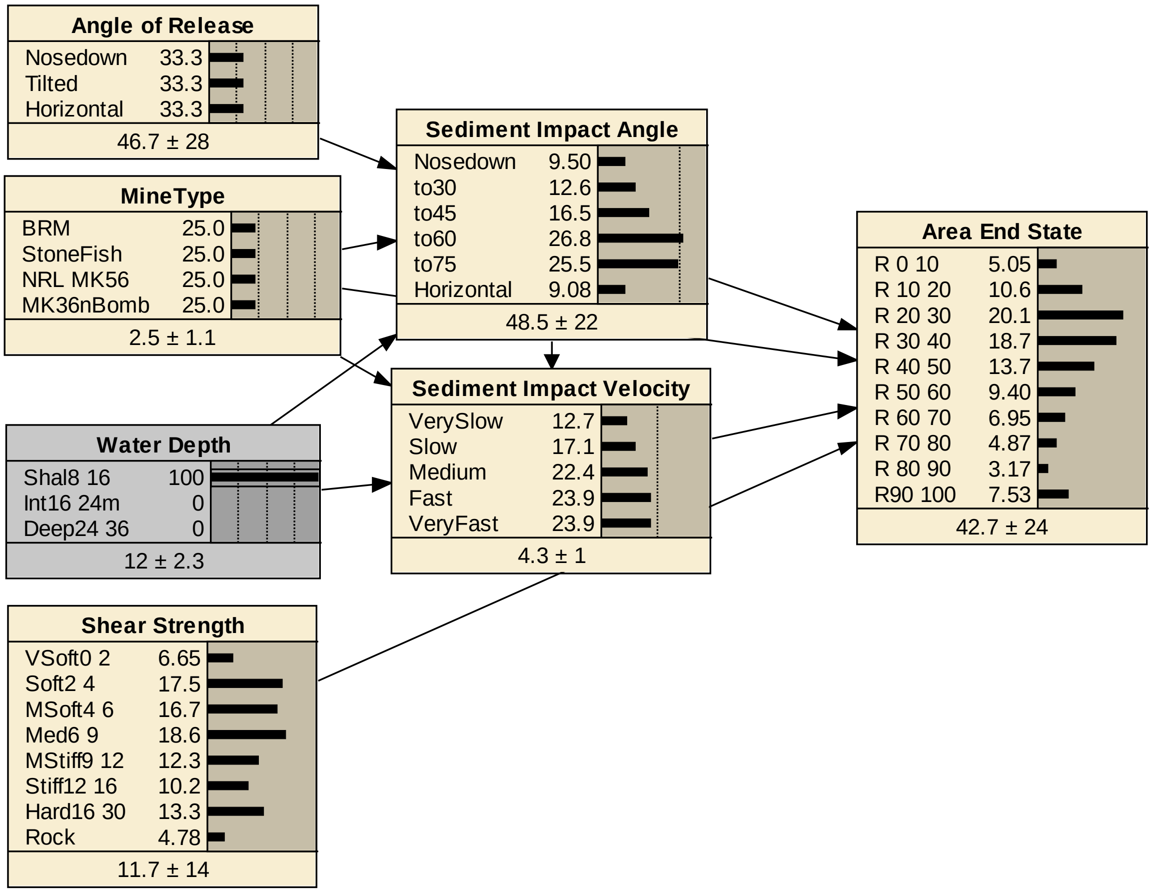

Figure 20. The Bayesian network predicts mean 42.7% burial and 24% standard deviation with two known inputs; water depth is shallow and sediment type is silt.

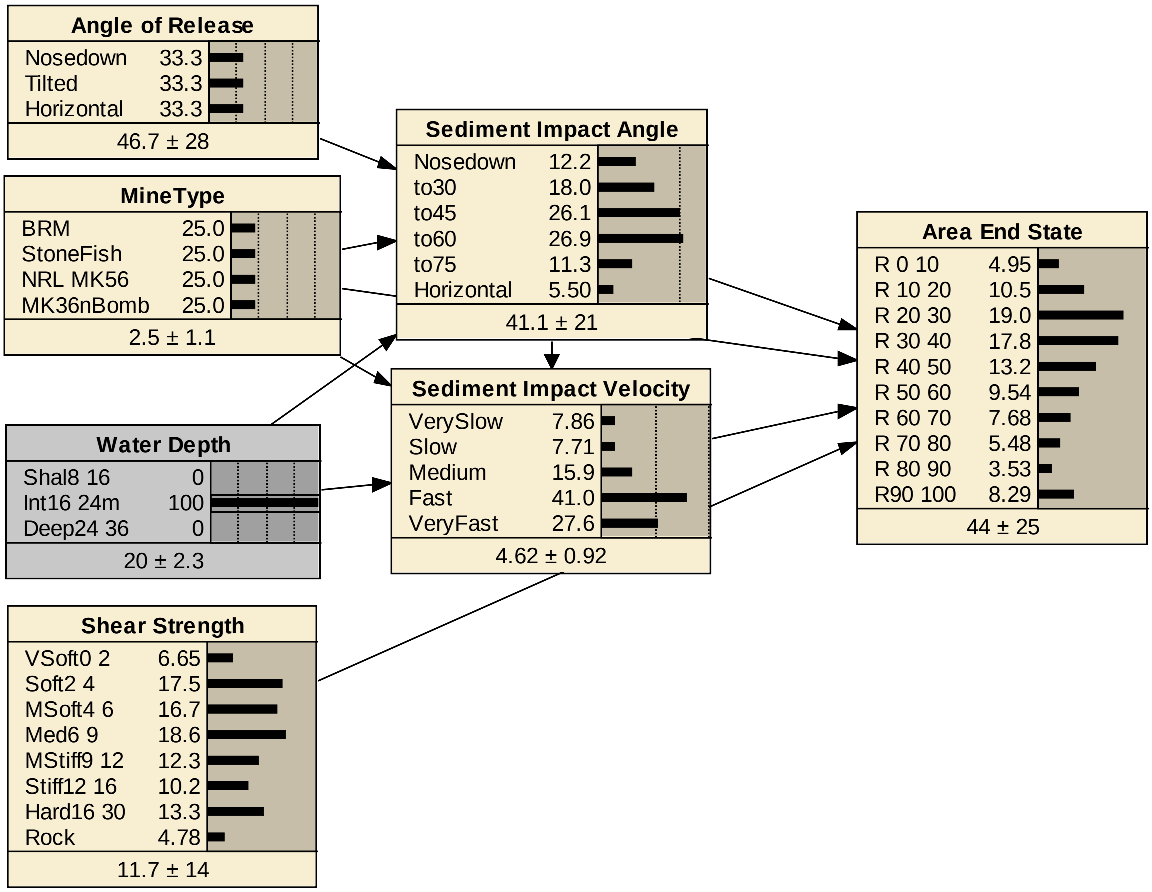

Figure 21. The Bayesian network predicts mean 44% burial and 25% standard deviation with two known inputs; water depth is intermediate and sediment type is silt.

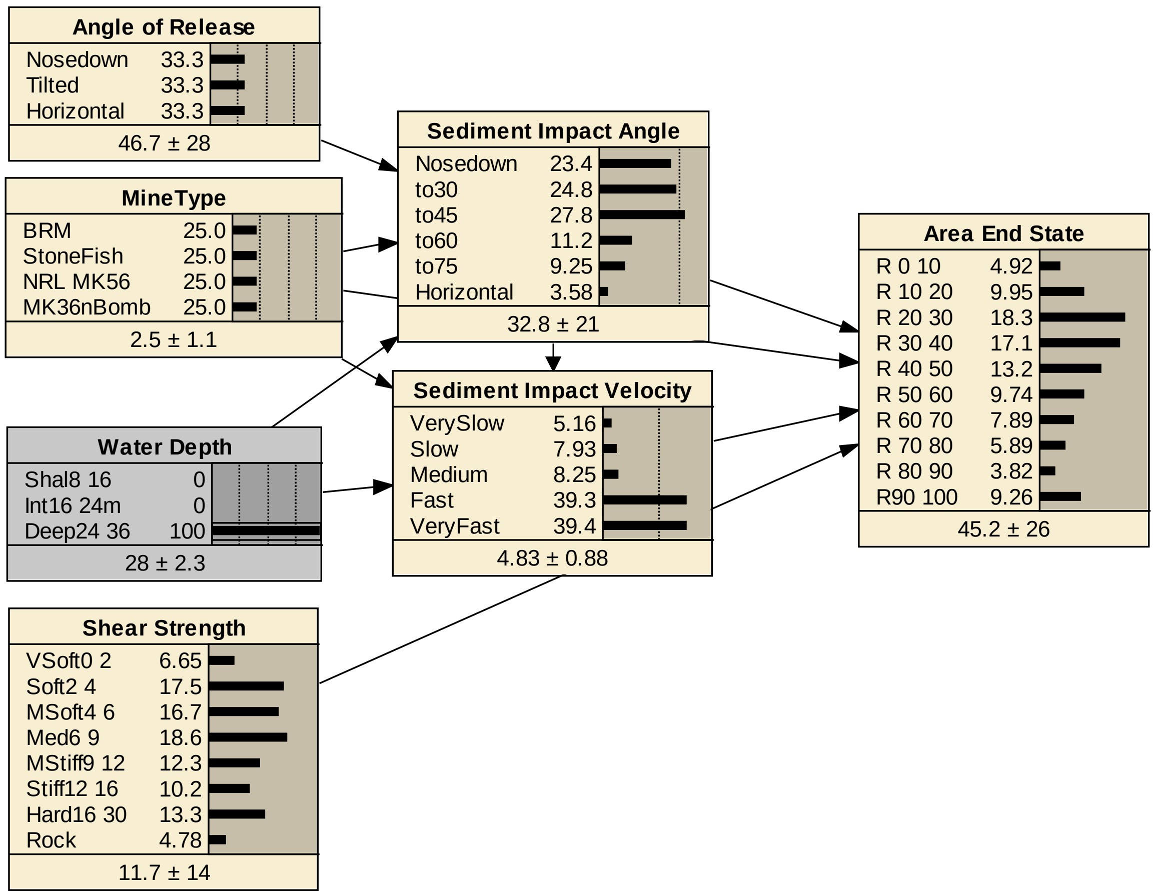

Figure 22. The Bayesian network predicts mean 45.2% burial and 26% standard deviation with two known inputs; water depth is deep and sediment type is silt.

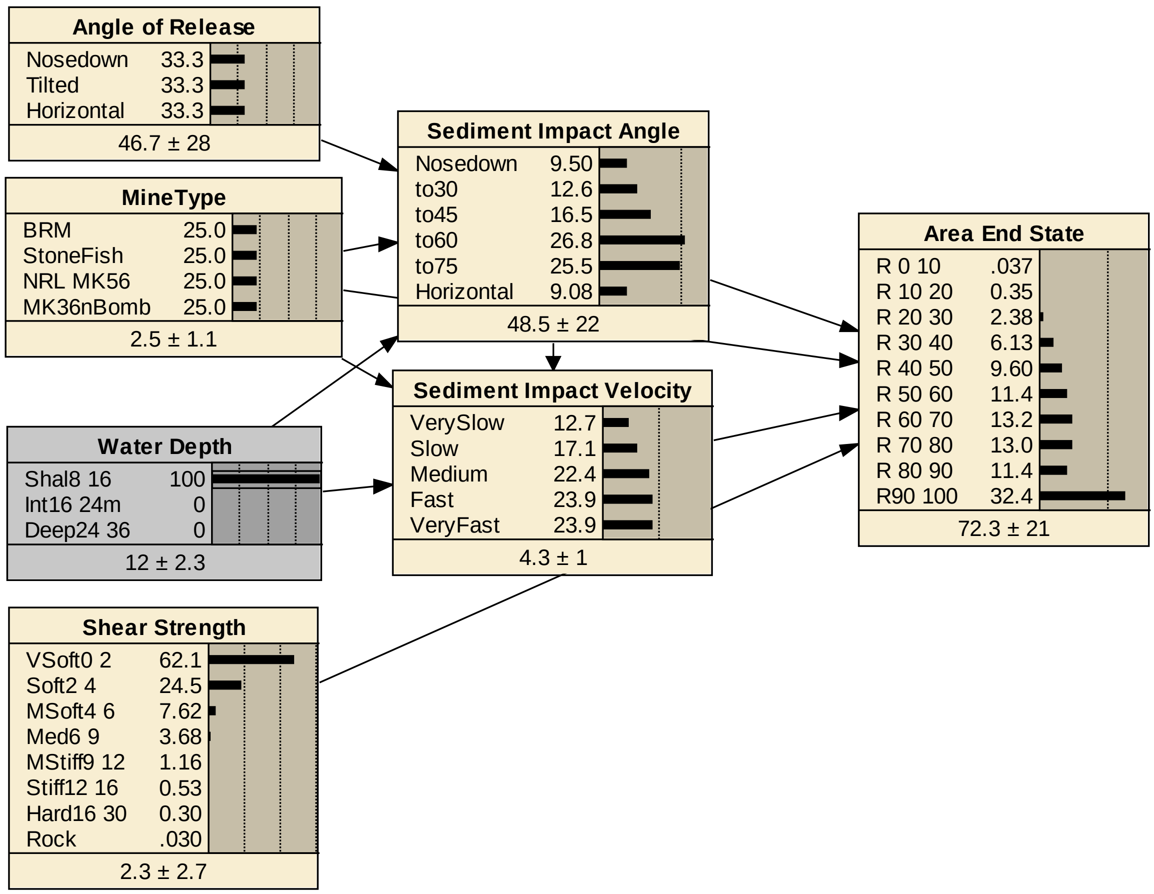

Figure 23. The Bayesian network predicts mean 72.3% burial and 21% standard deviation with two known inputs; water depth is shallow and sediment type is clay.

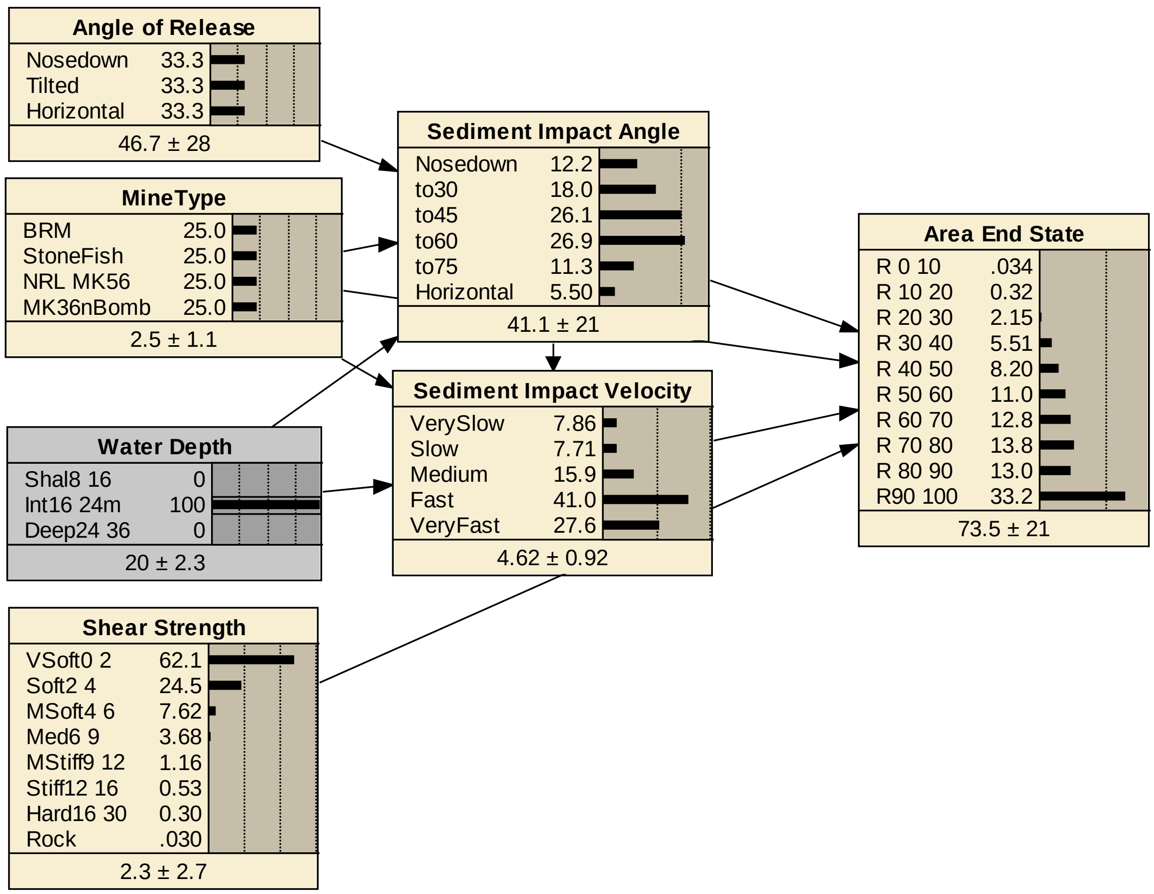

Figure 24. The Bayesian network predicts mean 73.5% burial and 21% standard deviation with two known inputs; water depth is intermediate and sediment type is clay.

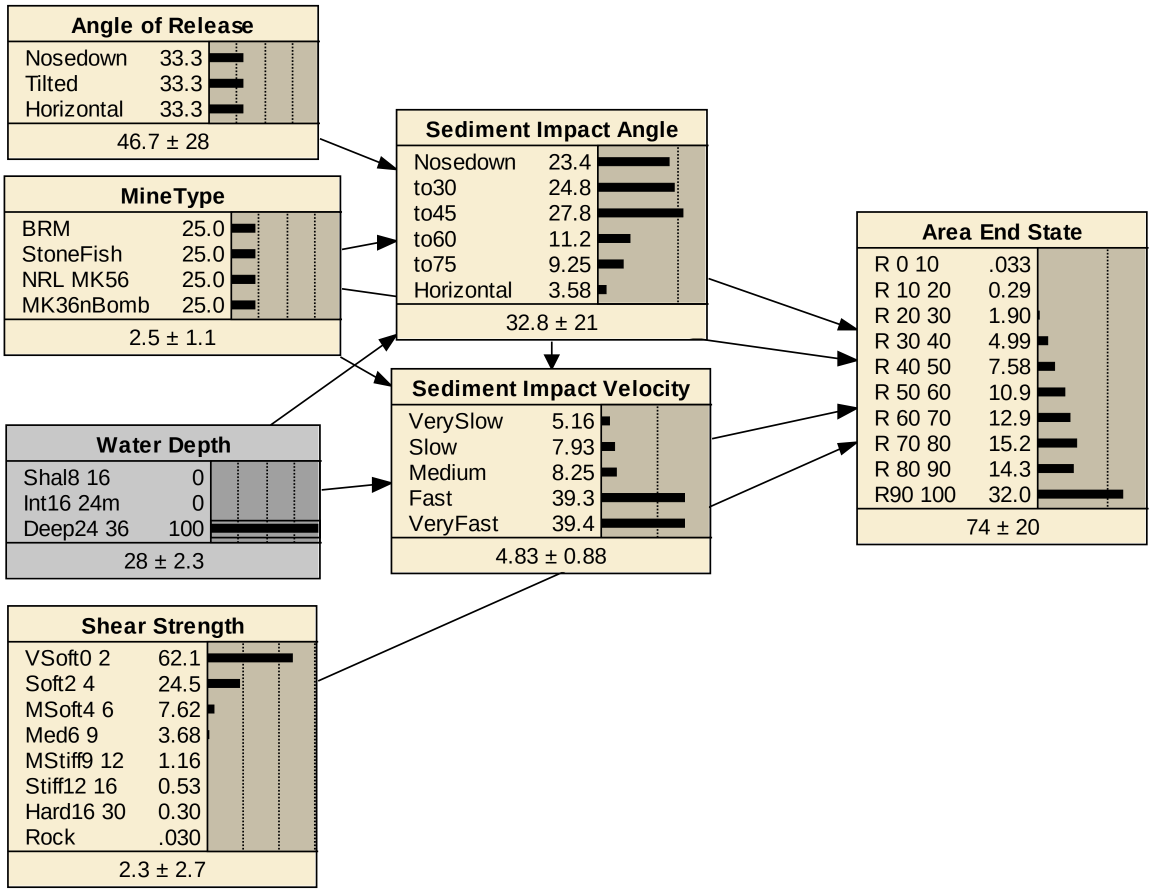

Figure 25. The Bayesian network predicts mean 74% burial and 20% standard deviation with two known inputs; water depth is deep and sediment type is clay.

5. Cummulative Results for Unknown Mine Type

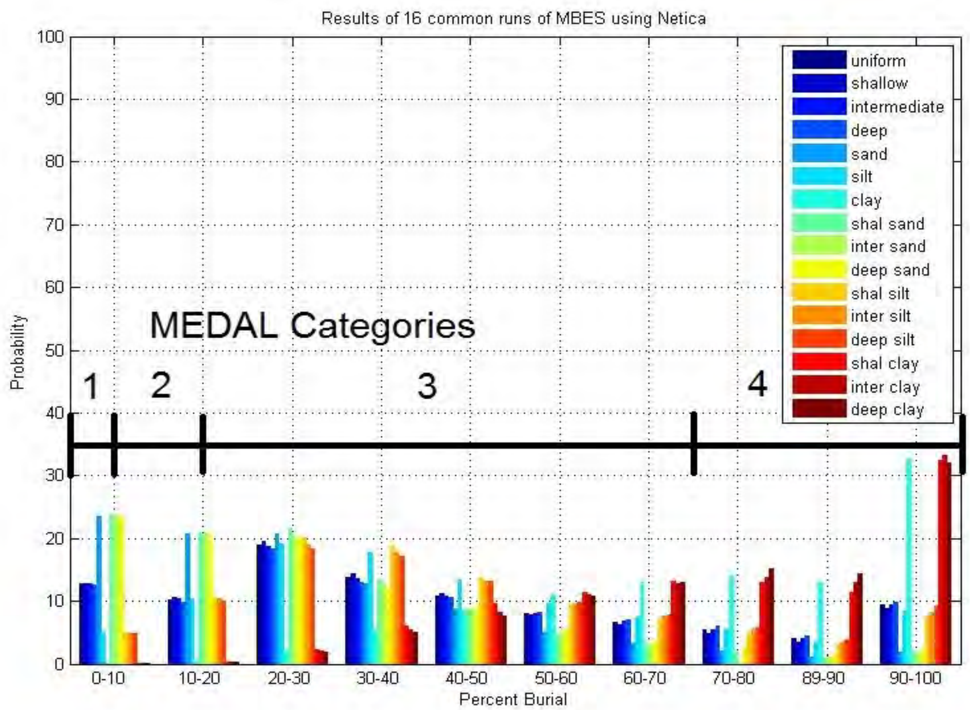

Figure 26. Cumulative plot of 16 scenarios available to current EPMA users. Legend shows known input parameters. Overlaid on plot are doctrinal sediment categories (bins) for MEDAL.

Figure 26 supports the current binning scheme in MIW doctrine, because it is difficult to justify separating the categories or adding new ones. The majority of the distribution for silt at all three depths falls under category 3. Without any more data or intelligence about the mine type or how it was placed, these predictions provide the best estimate of the mine burial upon impact. In fact, there is not sufficient data to separate any of the categories. When building the doctrinal categories, it must have made sense to assign sand to category 1 or 2, silt to category 3, and clay to category 4 based on how much of each distribution falls in those categories. These initial results are thought to have been the reason for the doctrinal categories to begin with.

The problem here lies in the fact that today there are over 400 different enhanced sediment types in the NAVO database.

6. Complex Sediment Types

With today's technology, we have the ability to more accurately characterize the seafloor. With MBES, we can take all available data, with variability, and calculate a prediction for mine burial with appropriate confidence. The doctrinal categories are not sufficient to quantify burial estimates in complex sediment types. Figures 27 and 28 show the model outputs for silty clay and clayey silt respectively. Figure 29 shows the comparison of the two enhanced sediments. It is clear from Figure 29 that the majority of both distributions fall into category 3 as well as the mean burial of both sediments, but the predicted mean burial differs by 11.2%. This could create substantial errors in planning for a MCM mission, when assets and time are expensive. Comparing these two sediment types clearly shows the need for more bins for categorizing burial predictions. Because of the wide variety of enhanced sediments throughout the world, the best use of the MBES would be to use all 10 output bins.

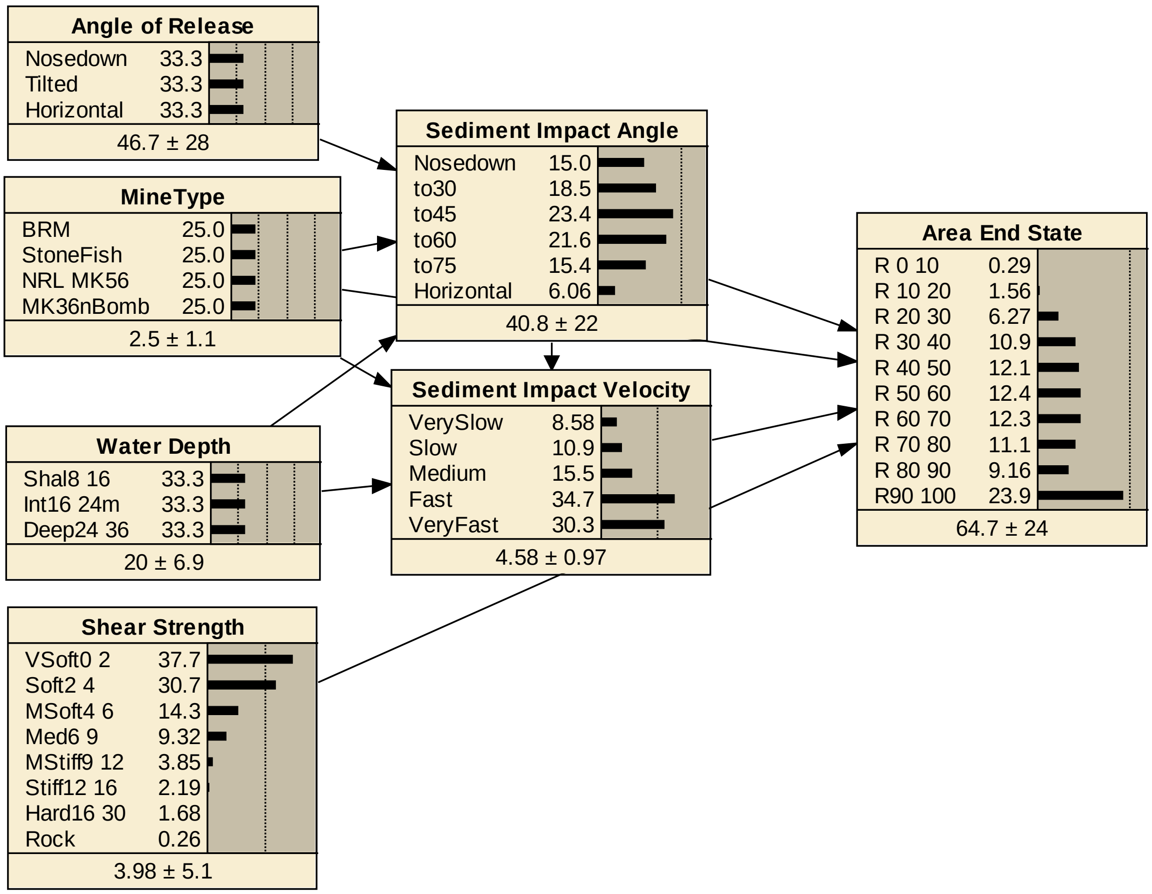

Figure 27. The Bayesian network predicts mean 64.7% burial and 24% standard deviation with the lognormal shear strength distribution of silty clay.

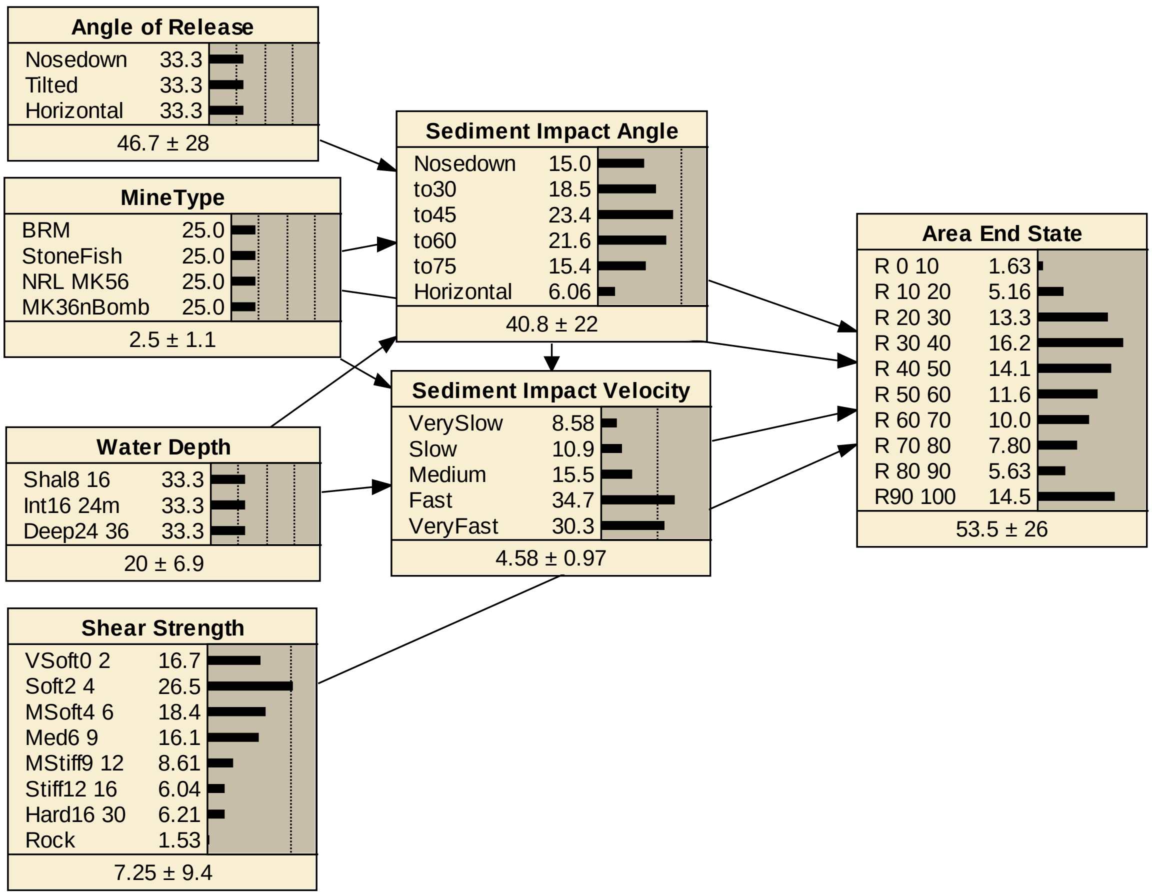

Figure 28. The Bayesian network predicts mean 53.5% burial and 26% standard deviation with the lognormal shear strength distribution of clayey silt

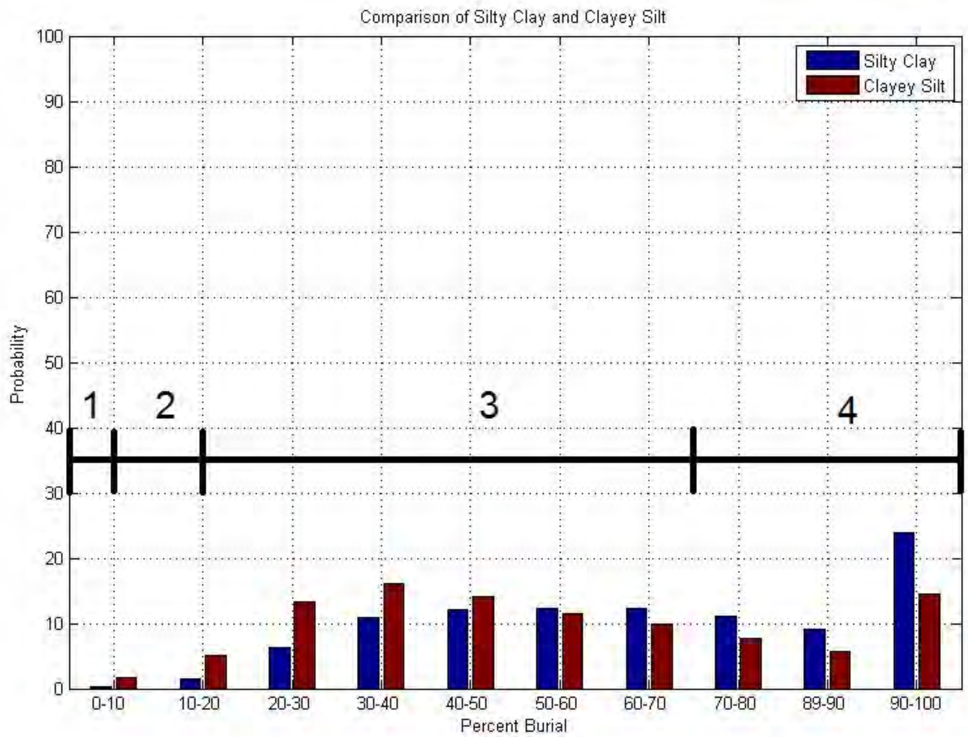

Figure 29. Comparison of MBES prediction of impact burial in silty clay and clayey silt shows the poor resolution of doctrinal categories.

C. RESULTS FOR KNOWN MINE TYPE

It is very likely that intelligence could give the MIW planner an indication of mine type and possibly the method of deployment. As the knowledge of the input parameters increases, the need for the resolution of all 10 bins of the output distribution also increases. Table 4 lists burial predictions for the three main sediment types sand, silt, and clay. The input parameter for mine type varies for all three sediment types. Figures 27 through 38 show the results from the Bayesian network with a comparison plot after each sediment type. One interesting observation is the relatively low variability of the output when mine type is known. There were also a couple of trends that came forward when looking at the results. First, knowing the mine type was similar to the MK36 mine resulted in significantly greater burial in all three sediment types. Also, the NRL MK56 mine type showed greater burial in sand and silt, but not in clay. There

would certainly be more interesting data to analyze if one were to include more mine types and different sediments. Nevertheless, the data clearly show the need for all 10 bins of the output distribution from the MBES.

Table 4. Summary of prediction results for sand, silt, and clay and all four mine types available in current version of the MBES.

Figure No.	Scenario	Mean burial (µ)	Standard Deviation (σ)
30	Sand SS dist, BRM mine	18.9	12
31	Sand SS dist, Stonefish mine	21.7	16
32	Sand SS dist, NRL MK56 mine	23.6	16
33	Sand SS dist, MK36 mine	44.6	28
34	Sand comparison		
35	Silt SS dist, BRM mine	30.6	16
36	Silt SS dist, Stonefish mine	38.7	22
37	Silt SS dist, NRL MK56 mine	39.4	20
38	Silt SS dist, MK36 mine	67.1	25
39	Silt comparison		
40	Clay SS dist, BRM mine	56	17
41	Clay SS dist, Stonefish mine	76	20
42	Clay SS dist, NRL MK56 mine	69.9	17
43	Clay SS dist, MK36 mine	91	11
44	Clay comparison		

1. Known Mine Type in Sand

Before knowing anything about the mine type, burial predictions for sand generally fell into category 1 or 2, but it can be seen in Figure 34 that two of the mine types (NRL MK56 and MK36) now put the prediction in Category 3.

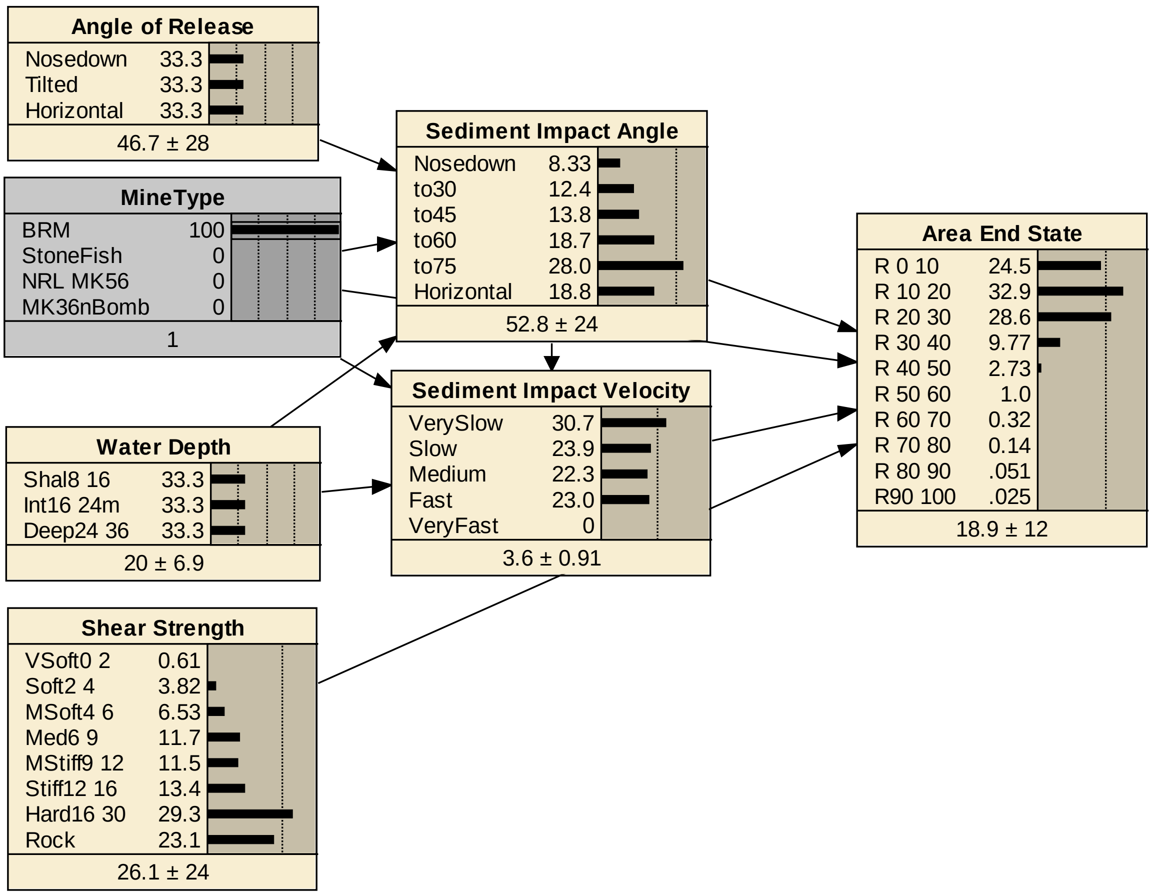

Figure 30. The Bayesian network predicts mean 18.9% burial and 12% standard deviation with two known inputs; mine type is BRM and sediment type is sand.

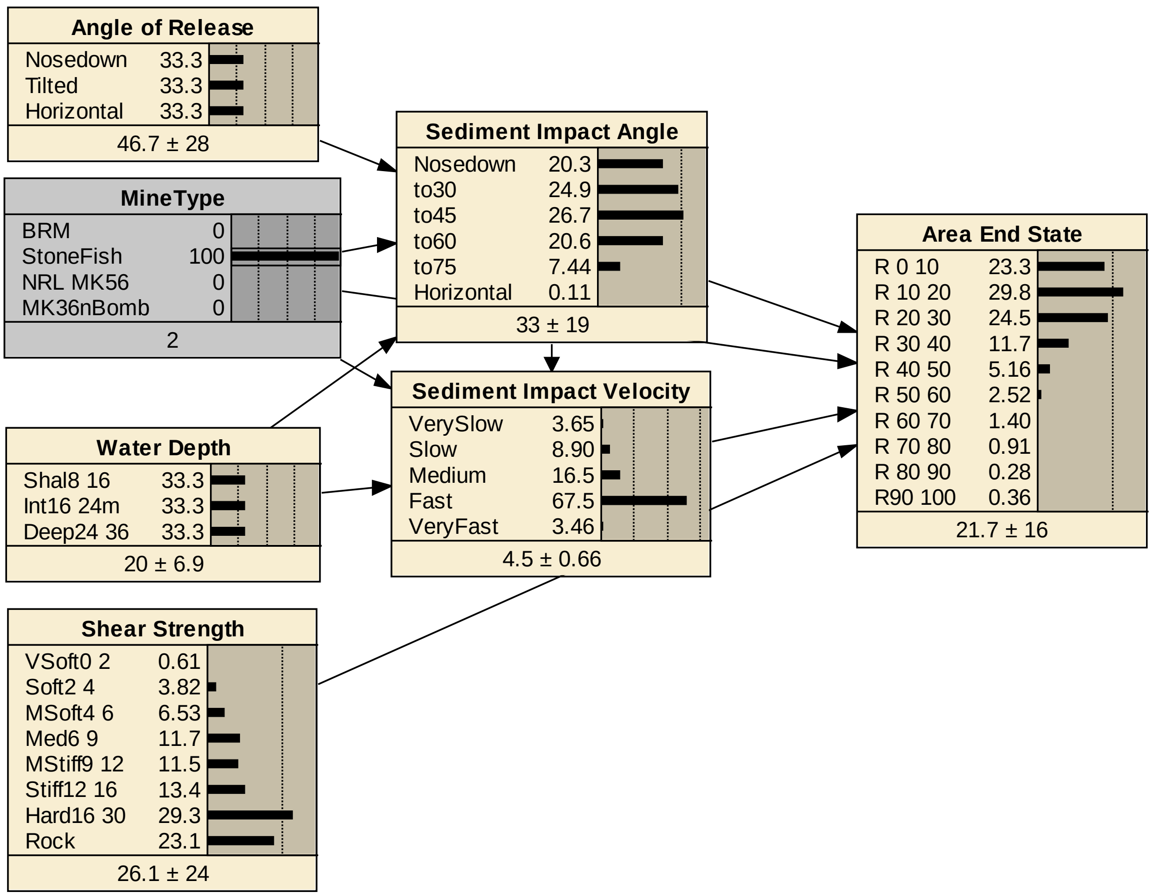

Figure 31. The Bayesian network predicts mean 21.7% burial and 16% standard deviation with two known inputs; mine type is Stonefish and sediment type is sand.

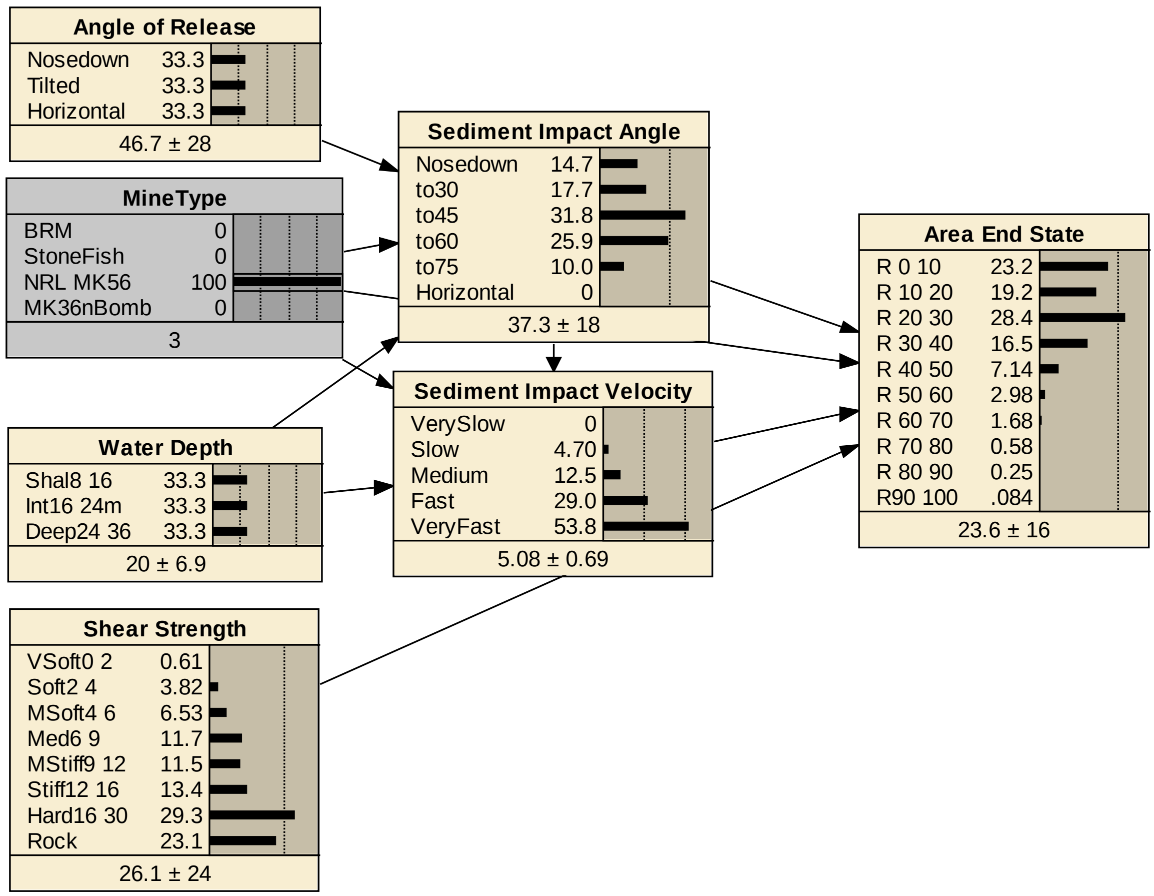

Figure 32. The Bayesian network predicts mean 23.6% burial and 16% standard deviation with two known inputs; mine type is NRL MK56 and sediment type is sand.

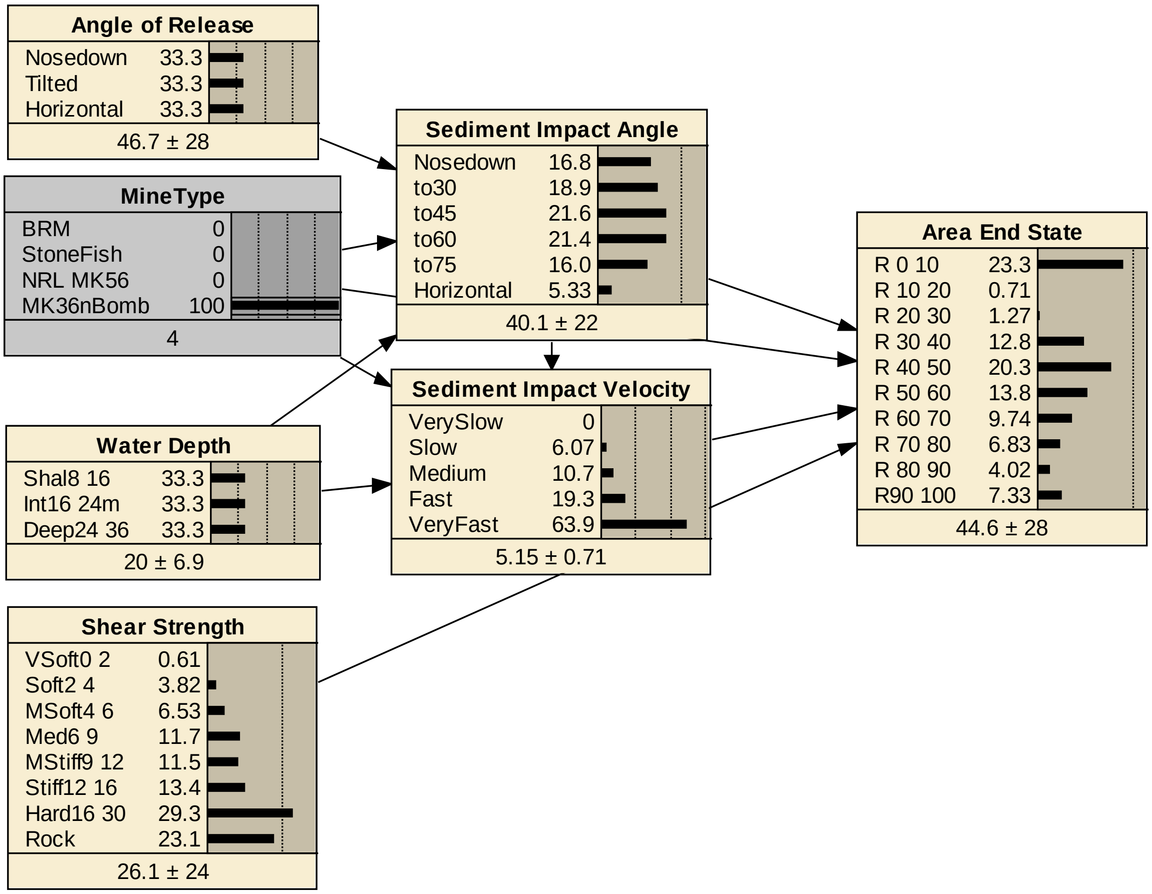

Figure 33. The Bayesian network predicts mean 44.6% burial and 28% standard deviation with two known inputs; mine type is MK36 and sediment type is sand.

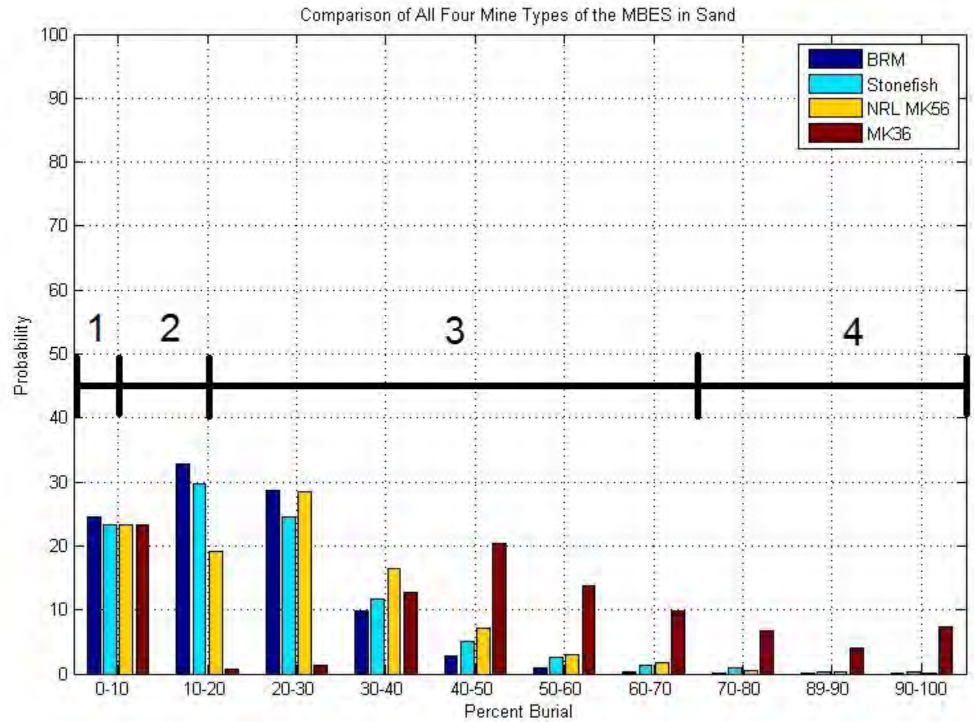

Figure 34. Comparison of the predicted burial of all four mine types in sand.

2. Known Mine Type in Silt

The results of different mine types in silt are similar to those of the complex sediments silty clay and clayey silt. Most of the mine types fall into doctrinal category 3, so there is no way to take advantage of knowing that one mine exists and another does not. These results are the most clear in showing the need for all 10 bins because these results could be split into three different bins.

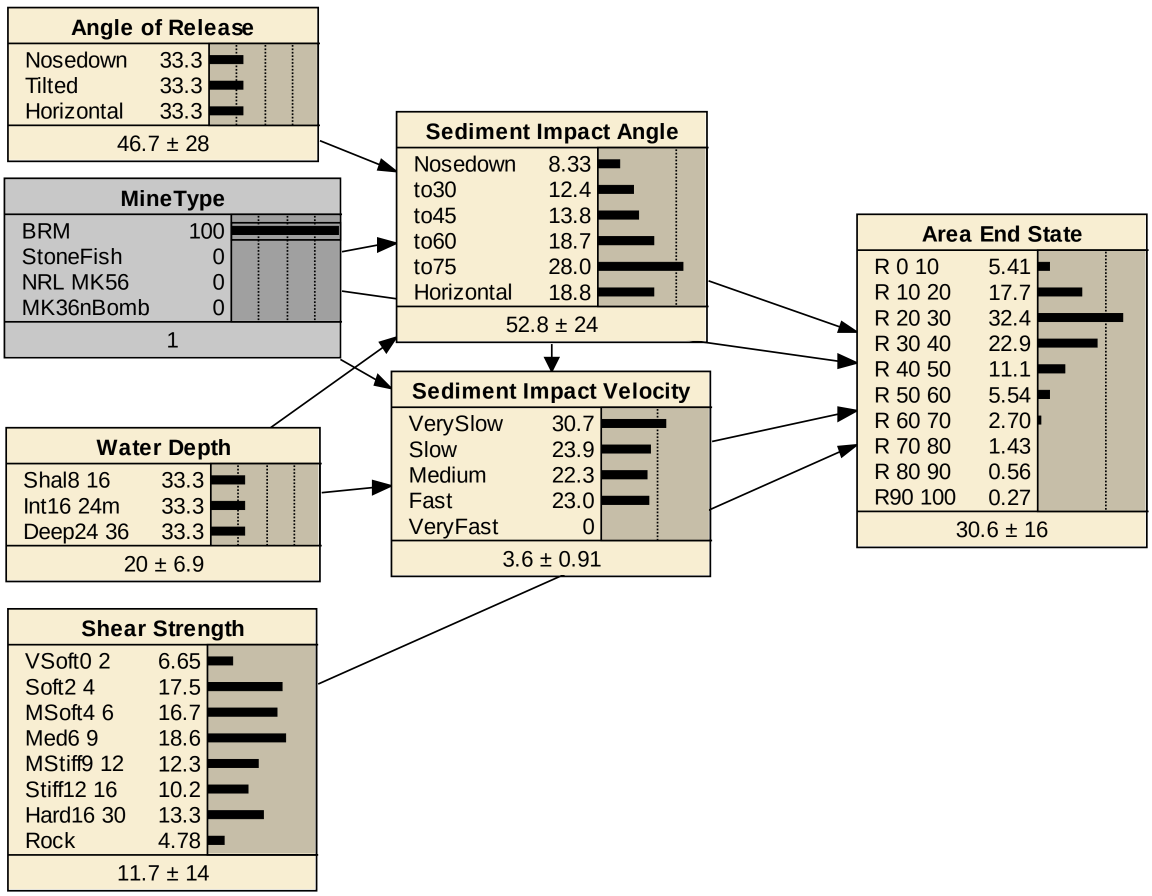

Figure 35. The Bayesian network predicts mean 30.6% burial and 16% standard deviation with two known inputs; mine type is BRM and sediment type is silt.

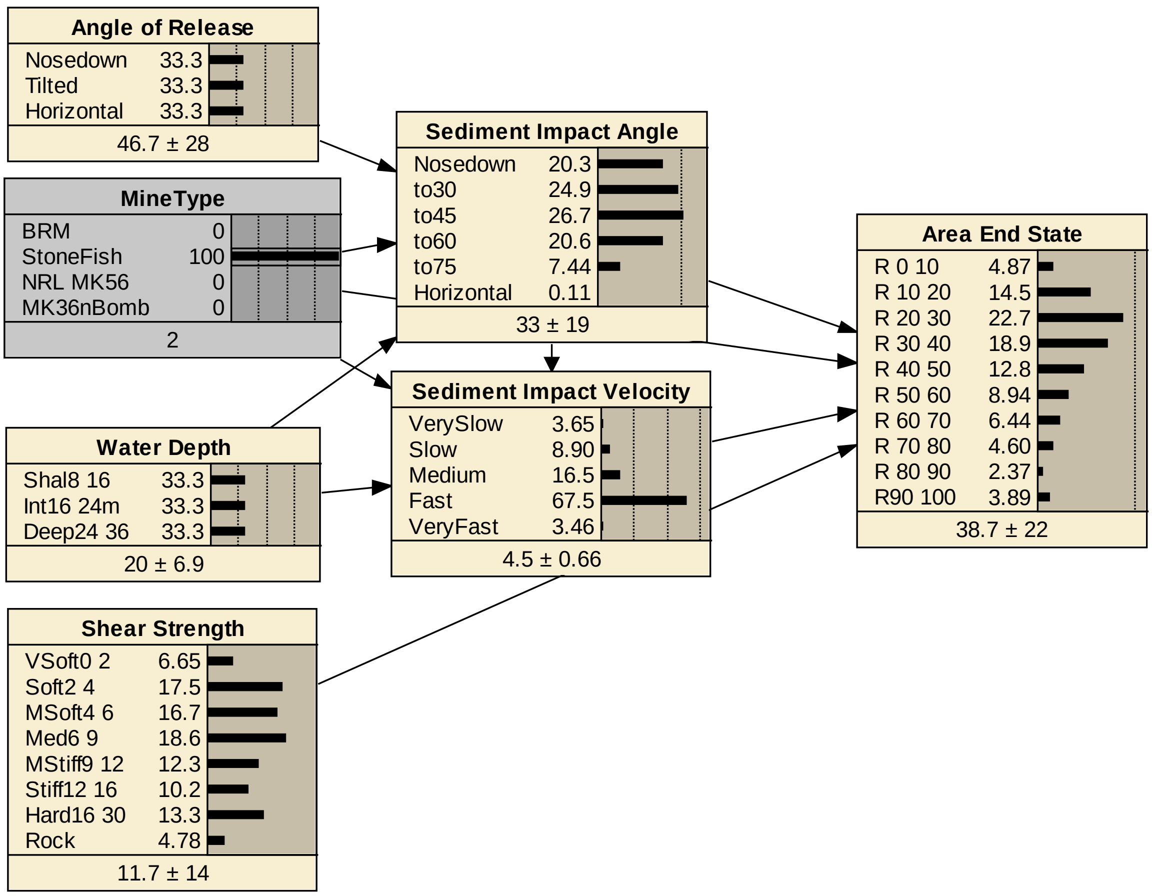

Figure 36. The Bayesian network predicts mean 38.7% burial and 22% standard deviation with two known inputs; mine type is Stonefish and sediment type is silt.

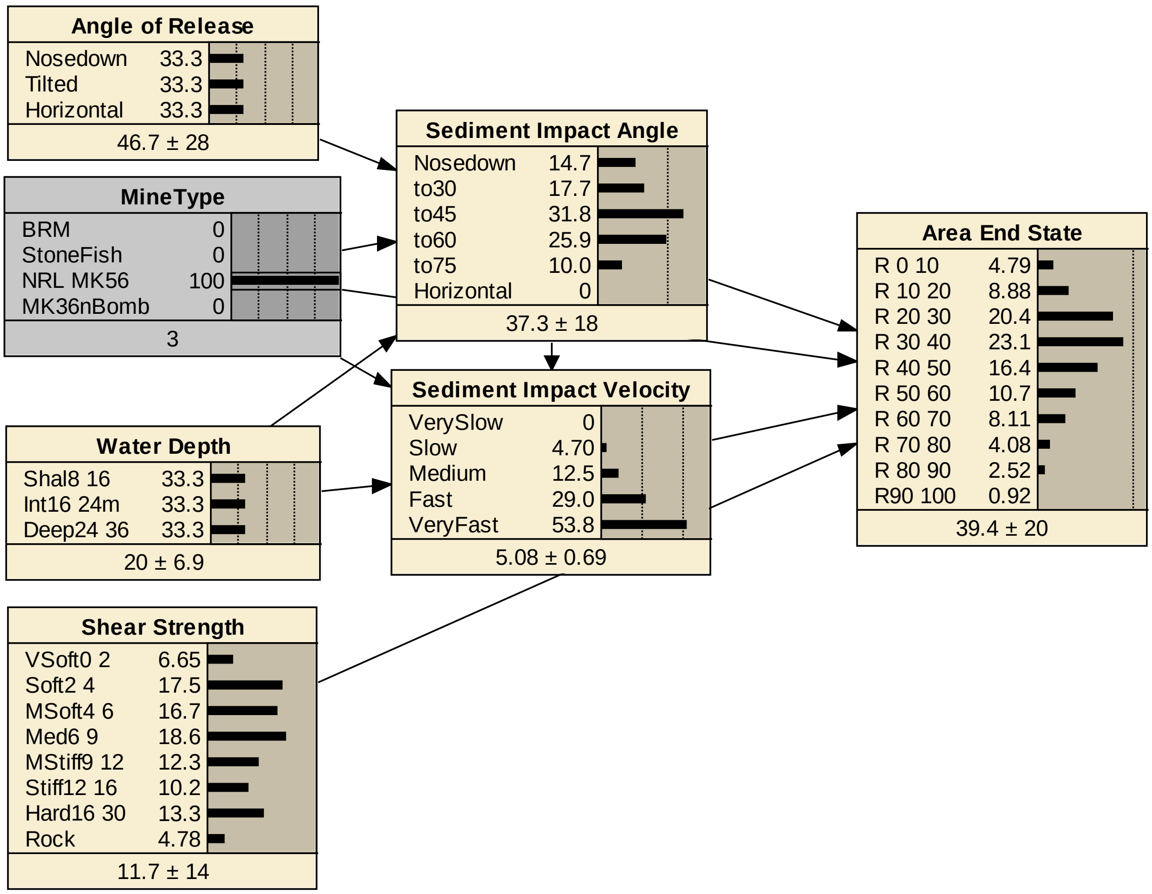

Figure 37. The Bayesian network predicts mean 39.4% burial and 20% standard deviation with two known inputs; mine type is NRL MK56 and sediment type is silt.

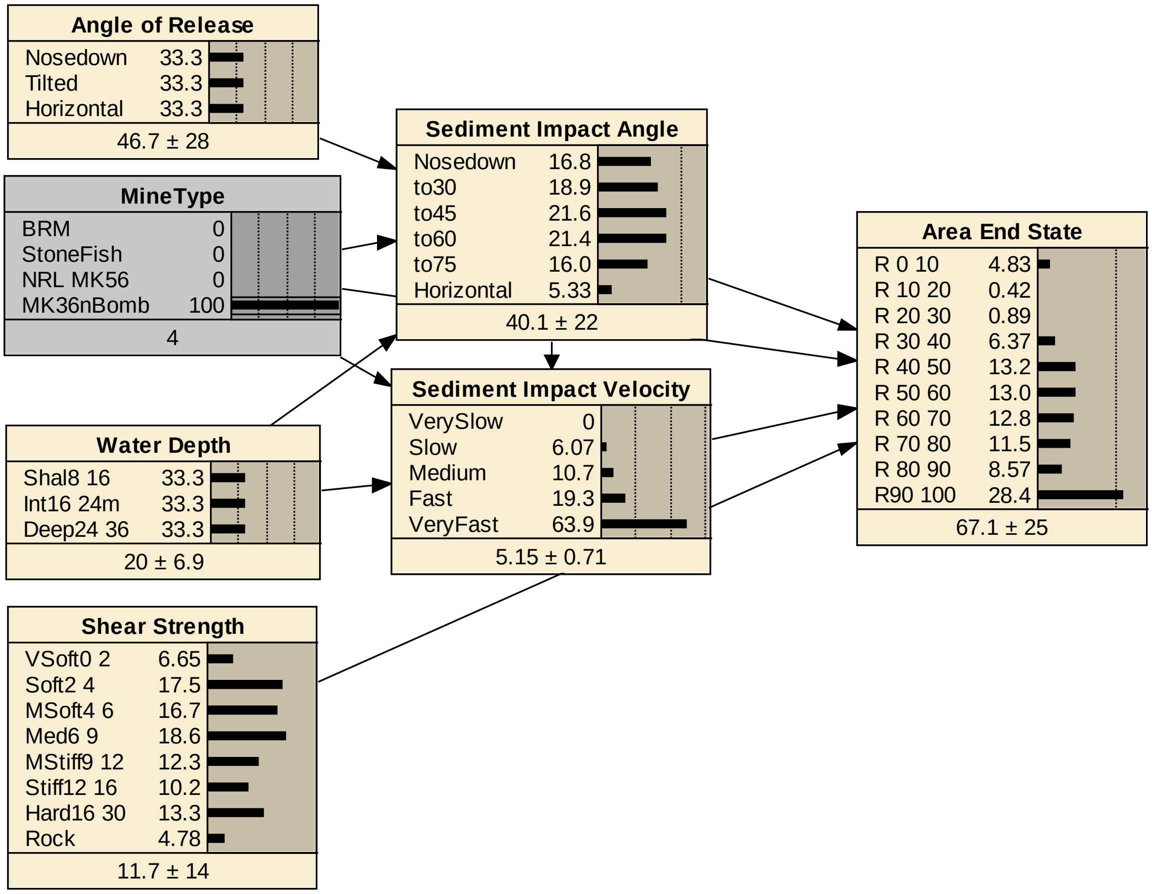

Figure 38. The Bayesian network predicts mean 67.1% burial and 25% standard deviation with two known inputs; mine type is MK36 and sediment type is silt.

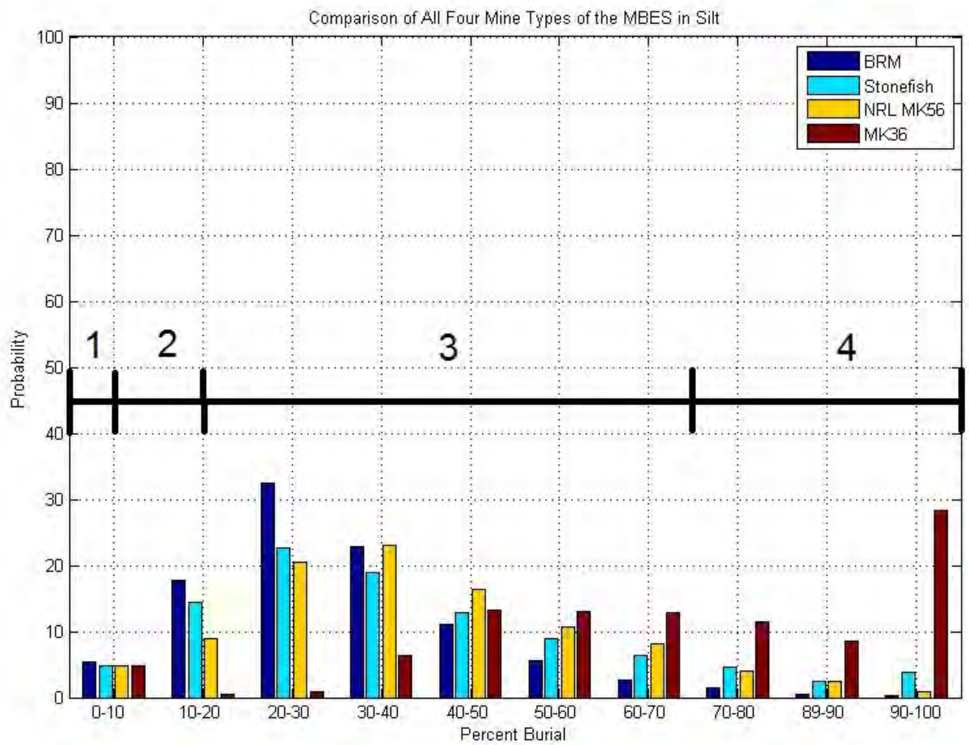

Figure 39. Comparison of the predicted burial of all four mine types in silt.

3. Known Mine Type in Clay

The results for clay follow suit in that most of the predictions would fall into doctrinal category 4. Without more bins, knowing the mine type does not have any effect on the overall prediction.

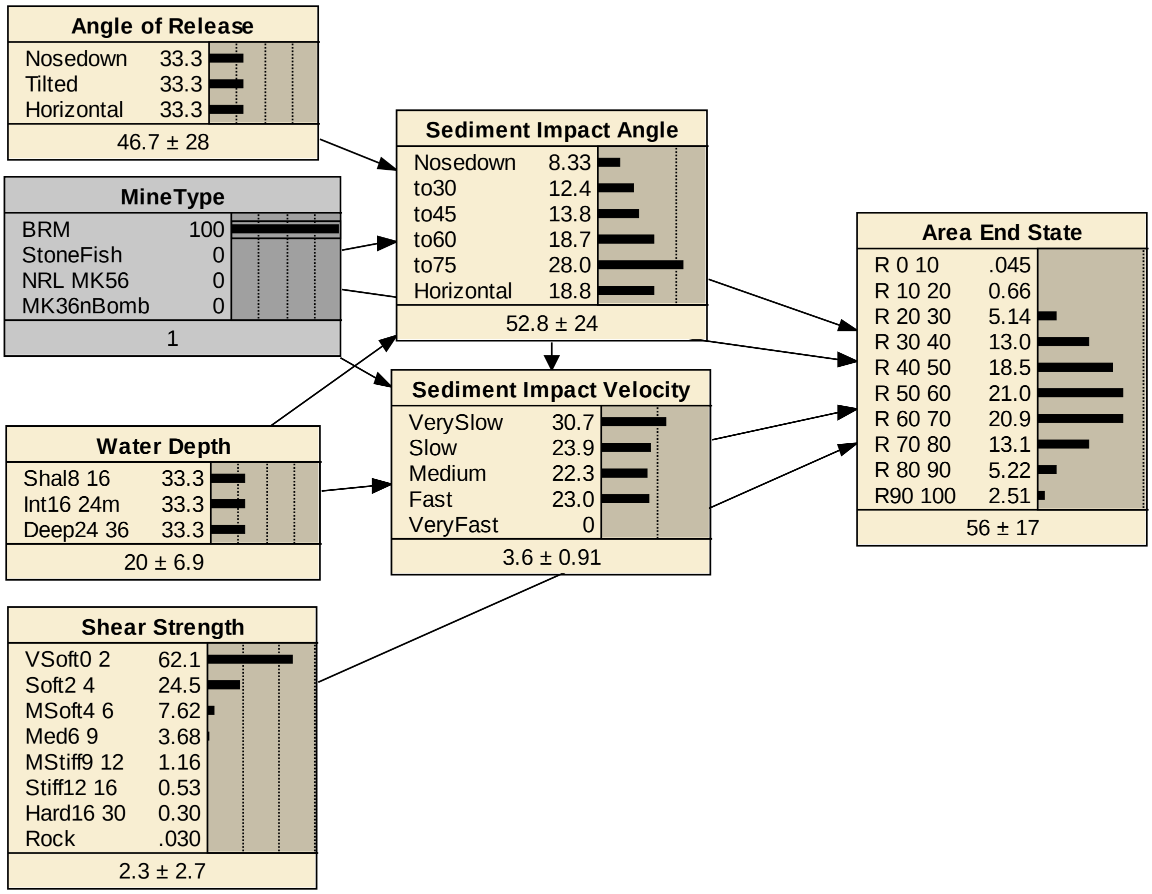

Figure 40. The Bayesian network predicts mean 56% burial and 17% standard deviation with two known inputs; mine type is BRM and sediment type is clay.

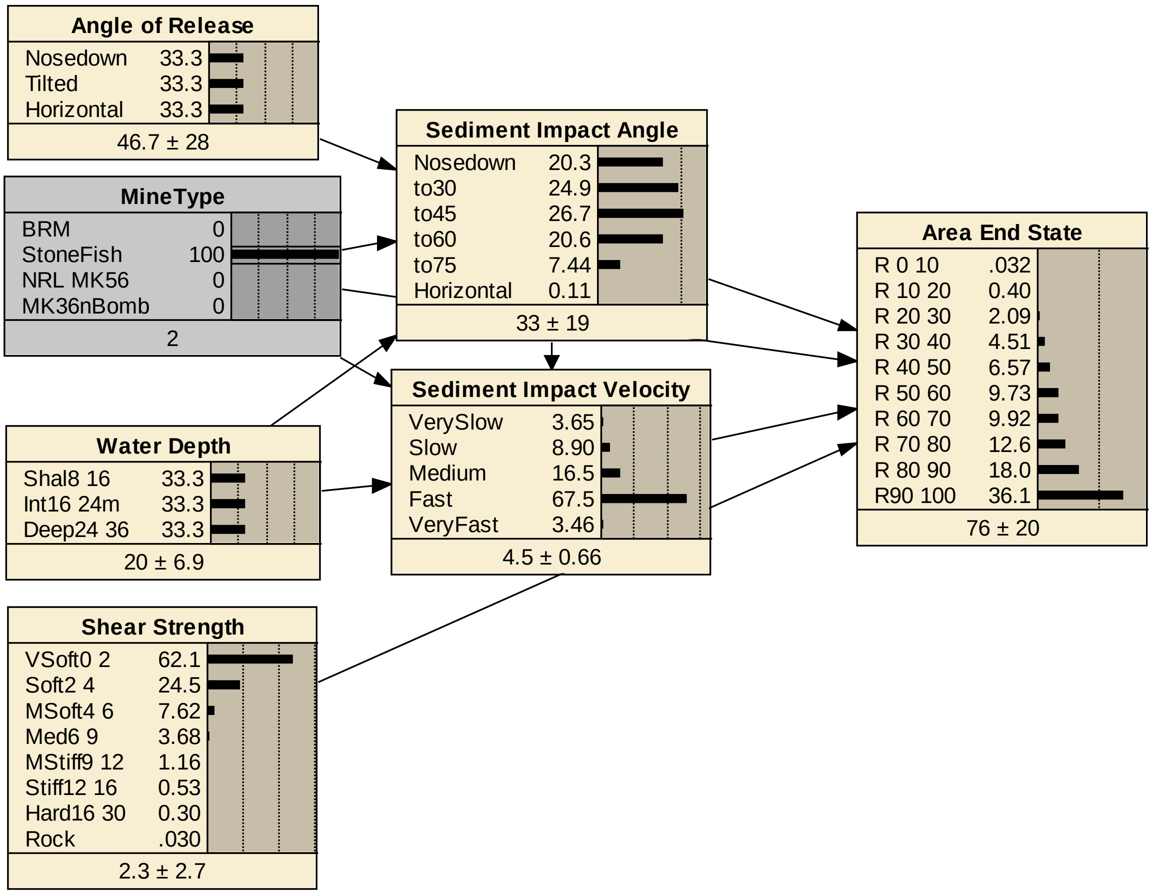

Figure 41. The Bayesian network predicts mean 76% burial and 20% standard deviation with two known inputs; mine type is Stonefish and sediment type is clay.

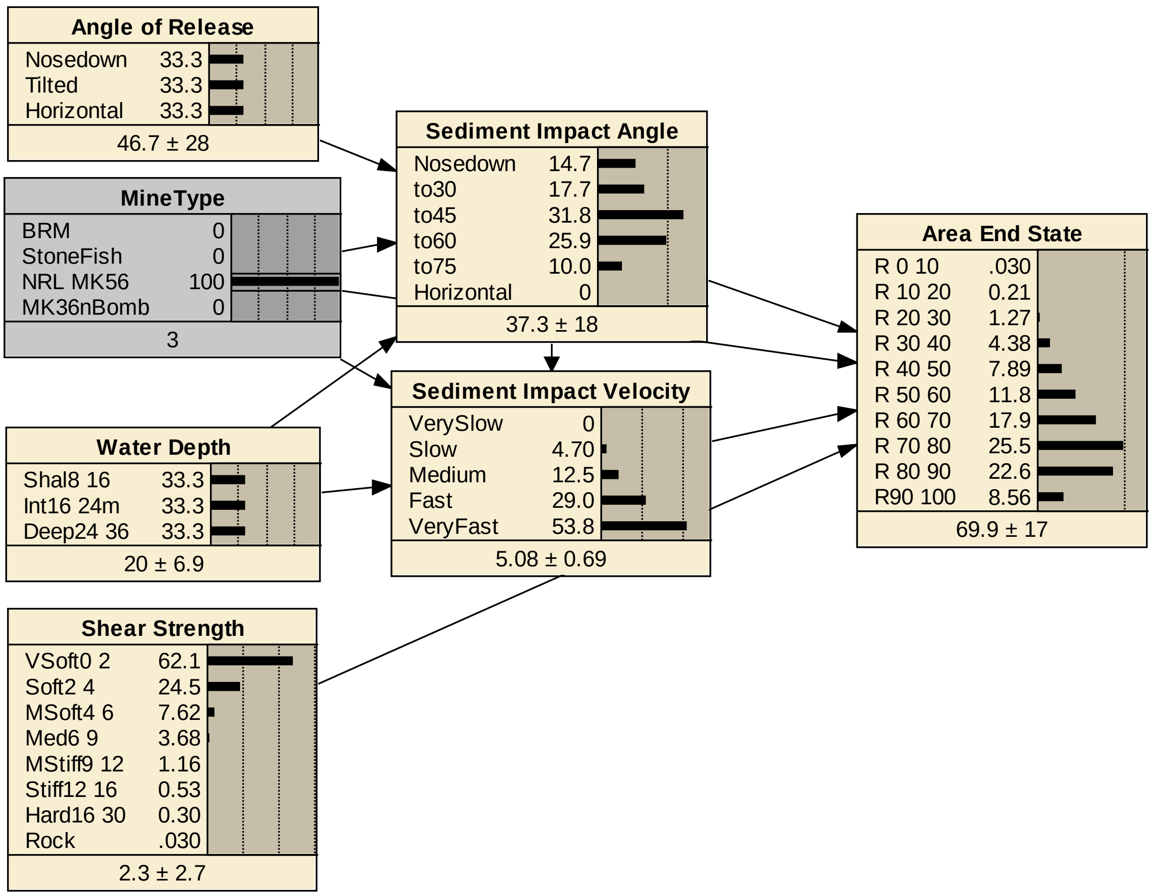

Figure 42. The Bayesian network predicts mean 69.9% burial and 17% standard deviation with two known inputs; mine type is NRL MK56 and sediment type is clay.

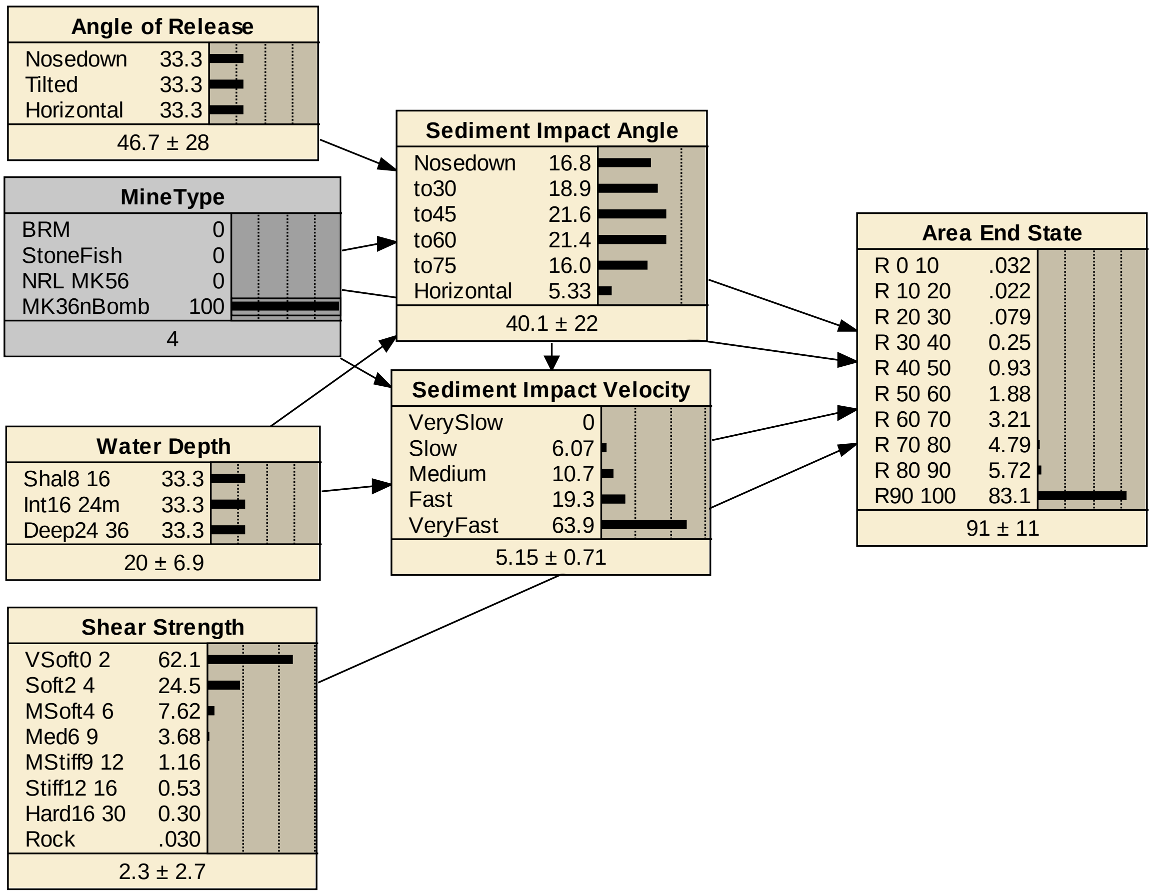

Figure 43. The Bayesian network predicts mean 91% burial and 11% standard deviation with two known inputs; mine type is MK36 and sediment type is clay.

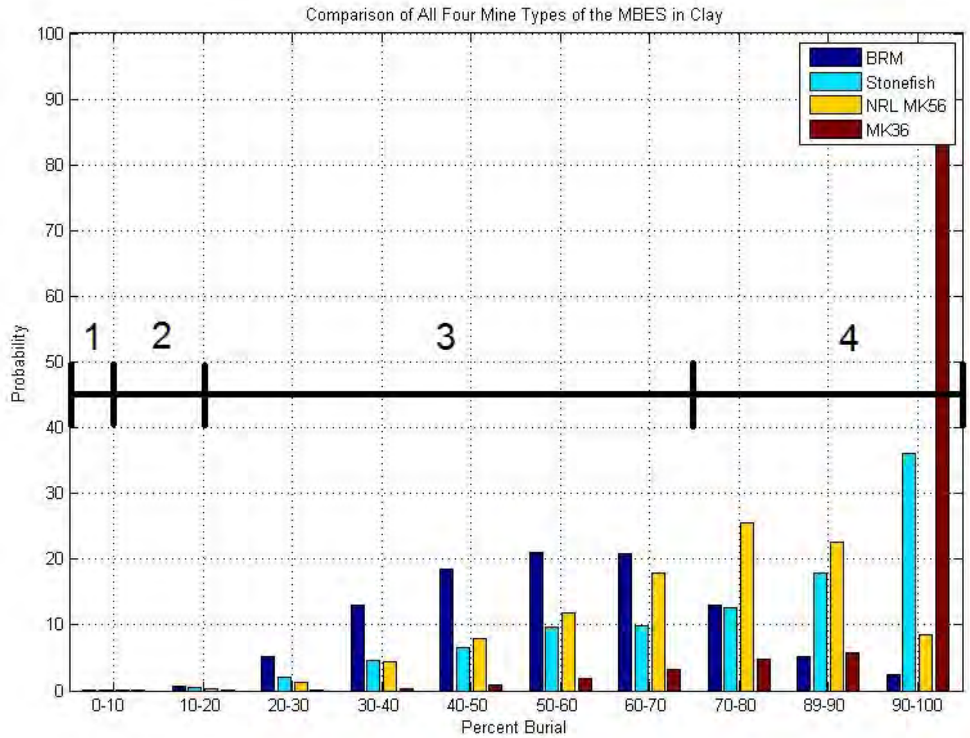

Figure 44. Comparison of the predicted burial of all four mine types in clay.

D. RISK PARAMETERIZATION FOR MCM OPERATIONS

The use of risk parameters has been outlined in the technical document for the MBES [15]. As part of the outline, the disparities between the output of the expert system and the MEDAL sediment categories were also discussed. As also found in this research, the doctrinal categories fall short of capturing the resolution of the prediction provided by the MBES. Category 3 (20–75% burial) of the doctrinal categories reflected the uncertainty of the knowledge used in early predictions. For predictions with the MBES, the variability of the output distribution characterizes this uncertainty. Using risk parameters and confidence intervals, doctrinal categories were directly compared with the output of the MBES. Figure 45 shows a 90% confidence interval for an output of the MBES and a corresponding confidence interval from the doctrinal categories. The parameters used in the MBES prediction define α as the cumulative probability over the distribution and β is the confidence interval. The confidence interval describes a burial

range in which β% of all mines are expected to lie. For β=90%, the burial range in the figure falls between α=5% and α=95% and has a confidence interval with a width of 50%. The doctrinal categories have a confidence interval with width 55% for all values of β.

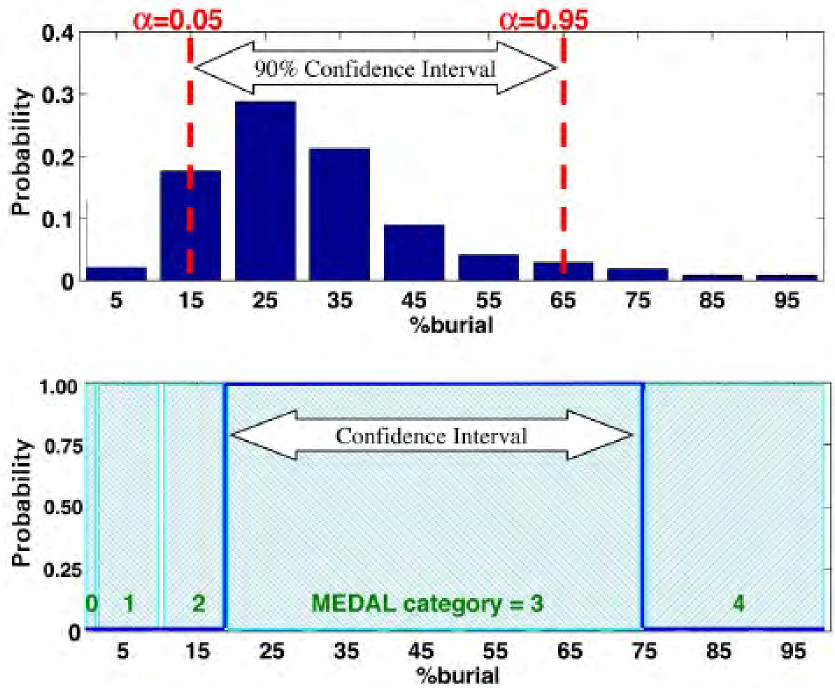

Figure 45. Confidence intervals from the MBES compared to MEDAL categories.

Although the MBES risk parameterization gives a very valuable way of calculating operational risk based on the most current data, there is no way to interpret the parameter using doctrinal categories. The risk parameter gives commanders an idea of the range of possible burial in their area of interest. The parameters can be specified by the commander so that the cumulative burial of 5%, 10%, 50%, 90%, and 95% (among others) are known and can be translated into operational risk.

THIS PAGE INTENTIONALLY LEFT BLANK

VI. CONCLUSIONS AND RECOMMENDATIONS

A. OPTIMIZING MINE BURIAL PREDICTION WITH THE MBES

The original intent of this research was to find an optimal binning scheme for doctrine to capture the increased resolution provided by the MBES output distribution. The analysis of various model configurations has shown that all ten bins of the output distribution must be used to accurately represent the degree of burial for any situation. This is the case for current modeling capabilities and will certainly be the case for future models. The shear strength values of the enhanced sediment types are the primary reason that doctrinal categories fail to fully represent the burial prediction of the MBES, especially for mixed sediments with similar distributions to silt. We are able to characterize these sediments better today than we ever have, and that improvement will continue.

One major limitation of impact modeling that has been transferred to the MBES is that the only mine shape modeled is cylindrical mines. Future research into the hydrodynamic behavior of other mine shapes, such as the work on the IMPACT35 model, would make the MBES an even more valuable tool.

There are several aspects of current mine burial prediction techniques that can be improved upon that are not limited to modeling shortfalls. Current users of the EPMA tool have the ability to change the shear strength distribution and depth inputs to the MBES. Mine type and angle of release are difficult to characterize, but may be available through appropriate intelligence channels. The comparison of results among all four mine types in Chapter V Section B showed a large amount of mean variability between the mine types. Any information about the threat mine that could be given to the MBES would increase the reliability of the prediction. It seems that the EPMA tool should be modified to include mine type as an available input parameter.

Another area that MBES can improve MCM operations is in its integration with MEDAL. The risk parameter described in Chapter V Section C would be an excellent way to give MCM Commanders the full scope of risk involved as a result of uncertainty in the amount of burial. This risk parameter should be used either to change the characterization of the bottom type in MEDAL, to change to fraction of undetectable mines, or both. Using this approach, doctrinal categories should be eliminated altogether. The commanders should be given at least the low and high alpha values along with the 50^{th} percentile (mean) of the burial prediction in order for them to understand the risk and make appropriate decisions.

APPENDIX CODE AND SUPPLEMENTARY FILES

Bottom Type		Shear Strength Distribution (kPa)								
		0–2	2–4	4–6	6–9	9–12	12–16	16–30	>70	Σ
‘PT	Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘PT	Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘PT	Silty Clay’	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
‘PT	Clay’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘PT	Gravel’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘PT	Sandy Mud’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘PT	Mud’	0.2762124	0.2970496	0.1658848	0.1246544	0.0587601	0.0372614	0.0334699	0.0067075	1
‘PC	Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘PC	Silty Sand’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘PC	Sandy Silt’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘PC	Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘PC	Clayey Silt’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘PC	Silty Clay’	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
‘PC	Clay’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘PC	Sand - Silt - Clay’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘PC	Marl’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘PC	Gravel’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘PC	Gravelly Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘PC	Coarse Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘PC	Medium Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘PC	Sandy Clay’	0.2762124	0.2970496	0.1658848	0.1246544	0.0587601	0.0372614	0.0334699	0.0067075	1
‘PC	Ooze’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘PS	Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘PS	Silty Clay’	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
‘PS	Clay’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘PS	Ooze’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘PS	Mud’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘P	Clayey Silt’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘P	Silty Clay’	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
‘P	Clay’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘PV	Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘PV	Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘PV	Silty Clay’	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
‘O	NO DATA’	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	0
‘L	LAND’	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	0
‘T	Rock’	0	0	0	0	0	0	0	1	1
‘T	Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Silty Sand’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘T	Sandy Silt’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘T	Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘T	Clayey Silt’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘T	Silty Clay’	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
‘T	Clay’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1

‘T	Sand - Silt - Clay’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘T	Gravel’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘T	Sandy Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Silty Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Muddy Sandy Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Clayey Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Muddy Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Gravelly Muddy Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Gravel - Silty Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Gravelly Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Very Coarse Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Coarse Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Medium Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Fine Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Very Fine Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Clayey Sand’	0.0549202	0.1524184	0.1530047	0.180103	0.1254843	0.1099096	0.1574853	0.0666744	1
‘T	Gravel - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘T	Gravelly Silt’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘T	Gravelly Silt - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Gravelly Sandy Silt’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Gravelly Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘T	Gravel - Sand - Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘T	Rock - Sand - Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘T	Rock - Gravel - Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘T	Rock - Gravel - Sand’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘T	Rock - Gravel - Sand - Mud’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Gravelly Clay’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘T	Sand - Clay - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Sandy Clay’	0.2762124	0.2970496	0.1658848	0.1246544	0.0587601	0.0372614	0.0334699	0.0067075	1
‘T	Coral Debris - Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Coarse Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘T	Very Fine Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘T	Fine Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘T	Medium Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘T	Coarse Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘T	Rough Rock’	0	0	0	0	0	0	0	1	1
‘T	Mud over Rock’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘T	Silty Clay - Shell’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘T	Boulders’	0	0	0	0	0	0	0	1	1
‘T	Cobbles (Stones) - Shell’	0	0	0	0	0	0	0	1	1
‘T	Pebbles - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1

'T	Granules'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Sand - Silt - Clay - Shell'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'T	Gravel - Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'T	Rock - Gravel - Sand - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'T	Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Rock - Gravel'	0	0	0	0	0	0	0	1	1
'T	Rock - Coral'	0	0	0	0	0	0	0	1	1
'T	Rock - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Rock - Mud'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'T	Mud - Shell'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'T	Gravel - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Gravel - Mud'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'T	Clayey Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Soft Mud'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'T	Hard Mud'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'T	Silty Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Gravelly Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Medium Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Fine Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Sandy Gravel - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'T	Clayey Silt - Shell'	0.0549202	0.1524184	0.1530047	0.180103	0.1254843	0.1099096	0.1574853	0.0666744	1
'T	Silt - Shell'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'T	Silty Gravel - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Sandy Silt - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Muddy Tidal Flats'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'T	Sandy Tidal Flats'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Sandy Muddy Tidal Flats'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'T	Sand Dune'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'T	Sand - Mud'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'T	Muddy Sand'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'T	Sandy Mud'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'T	Mud'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'T	Clay - Shell'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'T	Stiff Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'C	Rock'	0	0	0	0	0	0	0	1	1
'C	Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Silty Sand'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'C	Sandy Silt'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'C	Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'C	Clayey Silt'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'C	Silty Clay'	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
'C	Clay (Marl)'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'C	Sand - Silt - Clay'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1

'C	Ooze'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'C	Marl'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'C	Gravel (Shell Detritus)'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'C	Sandy Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Silty Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Muddy Sandy Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Clayey Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Muddy Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Gravelly Muddy Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Gravel - Silty Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Gravelly Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Very Coarse Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Coarse Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Medium Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Fine Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Very Fine Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Clayey Sand'	0.0549202	0.1524184	0.1530047	0.180103	0.1254843	0.1099096	0.1574853	0.0666744	1
'C	Oolite'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Gravel - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'C	Gravelly Silt'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'C	Gravelly Silt - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Gravelly Sandy Silt'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Gravelly Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'C	Gravel - Sand - Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'C	Rock - Sand - Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'C	Rock - Gravel - Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'C	Rock - Gravel - Sand'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'C	Rock - Gravel - Sand - Mud'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Gravelly Clay'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'C	Sand - Clay - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Sandy Clay (Sandy Marl)'	0.2762124	0.2970496	0.1658848	0.1246544	0.0587601	0.0372614	0.0334699	0.0067075	1
'C	Coral Debris - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Coral Debris - Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Coral Debris - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'C	Coarse Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Coral Debris - Sand - Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1

‘C	Coral Debris - Mud - Shell’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘C	Coral Debris - Mud’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘C	Very Fine Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘C	Fine Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘C	Medium Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘C	Coarse Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘C	Rough Rock’	0	0	0	0	0	0	0	1	1
‘C	Mud over Rock’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘C	Silty Clay - Shell’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘C	Coral Debris - Sand - Mud - Shell’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘C	Coral Debris’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘C	Coral’	0	0	0	0	0	0	0	1	1
‘C	Boulders’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘C	Cobbles (Stones) - Shell’	0	0	0	0	0	0	0	1	1
‘C	Pebbles - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘C	Granules’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Sand - Silt - Clay - Shell’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘C	Gravel - Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘C	Rock - Gravel - Sand - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘C	Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Rock - Gravel’	0	0	0	0	0	0	0	1	1
‘C	Rock - Coral’	0	0	0	0	0	0	0	1	1
‘C	Rock - Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Rock - Mud’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘C	Mud - Shell’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘C	Gravel - Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Gravel - Mud’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘C	Clayey Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Soft Mud’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘C	Hard Mud’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘C	Silty Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Gravelly Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Medium Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Fine Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Sandy Gravel - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘C	Clayey Silt - Shell’	0.0549202	0.1524184	0.1530047	0.180103	0.1254843	0.1099096	0.1574853	0.0666744	1
‘C	Silt - Shell’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘C	Silty Gravel - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Sandy Silt - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘C	Muddy Tidal Flats’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1

'C	Sandy Tidal Flats'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Sandy Muddy Tidal Flats'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'C	Sand Dune'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'C	Sand - Mud'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'C	Muddy Sand'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'C	Sandy Mud'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'C	Mud'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'C	Clay - Shell'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'C	Stiff Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'S	Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'S	Clay'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'S	Ooze'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'S	Mud'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'V	Rock'	0	0	0	0	0	0	0	1	1
'V	Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'V	Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'V	Gravel'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'V	Sandy Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'V	Gravelly Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'V	Rough Rock'	0	0	0	0	0	0	0	1	1
'V	Boulders'	0	0	0	0	0	0	0	1	1
'V	Rock - Gravel'	0	0	0	0	0	0	0	1	1
'V	Rock - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'V	Gravel - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'UC	Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'UC	Clayey Silt'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'UC	Silty Clay'	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
'UC	Clay'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'UC	Sand - Silt - Clay'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'UC	Ooze'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'UC	Marl'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'U.S.	Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'U.S.	Clay'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'U	Silty Sand'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'U	Sandy Silt'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'U	Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'U	Clayey Silt'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'U	Silty Clay'	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
'U	Clay'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'U	Sand - Silt - Clay'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'U	Fine Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'U	Gravel - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'U	Gravelly Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Rock'	0	0	0	0	0	0	0	1	1
'HC	Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Silty Sand'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Sandy Silt'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'HC	Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'HC	Clayey Silt'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'HC	Silty Clay'	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
'HC	Clay (Marl)'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1

'HC	Sand - Silt - Clay'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'HC	Ooze'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'HC	Marl'	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
'HC	Gravel (Shell Detritus)'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Sandy Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Silty Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Muddy Sandy Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Clayey Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Muddy Gravel'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Gravelly Muddy Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Gravel - Silty Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Gravelly Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Very Coarse Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Coarse Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Medium Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Fine Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Very Fine Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Clayey Sand'	0.0549202	0.1524184	0.1530047	0.180103	0.1254843	0.1099096	0.1574853	0.0666744	1
'HC	Gravel - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Gravelly Silt'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Gravelly Silt - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Gravelly Sandy Silt'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Gravelly Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Gravel - Sand - Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Rock - Sand - Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Rock - Gravel - Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Rock - Gravel - Sand'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Rock - Gravel - Sand - Mud'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Gravelly Clay'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'HC	Sand - Clay - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Sandy Clay (Sandy Marl)'	0.2762124	0.2970496	0.1658848	0.1246544	0.0587601	0.0372614	0.0334699	0.0067075	1
'HC	Coral Debris - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Coral Debris - Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Coral Debris - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Coarse Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Coral Debris - Sand - Mud'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1

'HC	Coral Debris - Mud - Shell'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'HC	Coral Debris - Mud'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'HC	Very Fine Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'HC	Fine Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'HC	Medium Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'HC	Coarse Silt'	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
'HC	Rough rock'	0	0	0	0	0	0	0	1	1
'HC	Mud over Rock'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'HC	Silty Clay - Shell'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
'HC	Coral Debris - Sand - Mud - Shell'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Coral Debris'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Coral'	0	0	0	0	0	0	0	1	1
'HC	Boulders'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Cobbles (Stones) - Shell'	0	0	0	0	0	0	0	1	1
'HC	Pebbles - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Granules'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Sand - Silt - Clay - Shell'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'HC	Gravel - Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Rock - Gravel - Sand - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Rock - Gravel'	0	0	0	0	0	0	0	1	1
'HC	Rock - Coral'	0	0	0	0	0	0	0	1	1
'HC	Rock - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Rock - Mud'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'HC	Mud - Shell'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Gravel - Sand'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Gravel - Mud'	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
'HC	Clayey Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Soft Mud'	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
'HC	Hard Mud'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Silty Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Gravelly Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Medium Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Fine Sand - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Sandy Gravel - Shell'	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
'HC	Clayey Silt - Shell'	0.0549202	0.1524184	0.1530047	0.180103	0.1254843	0.1099096	0.1574853	0.0666744	1
'HC	Silt - Shell'	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
'HC	Silty Gravel - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Sandy Silt - Shell'	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
'HC	Sand - Mud'	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1

‘HC	Muddy Sand’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘HC	Sandy Mud’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘HC	Mud’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘HC	Clay - Shell’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘HC	Stiff Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Rock’	0	0	0	0	0	0	0	1	1
‘HT	Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Silty Sand’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Sandy Silt’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘HT	Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘HT	Clayey Silt’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘HT	Silty Clay’	0.3769674	0.3070339	0.1430248	0.0931527	0.0385094	0.0218794	0.0168294	0.0026029	1
‘HT	Clay’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘HT	Sand - Silt - Clay’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘HT	Gravel’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HT	Sandy Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Silty Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Muddy Sandy Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Clayey Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Muddy Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Gravelly Muddy Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Gravel - Silty Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Gravelly Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Very Coarse Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Coarse Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Medium Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Fine Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Very Fine Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Clayey Sand’	0.0549202	0.1524184	0.1530047	0.180103	0.1254843	0.1099096	0.1574853	0.0666744	1
‘HT	Gravel - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HT	Gravelly Silt’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Gravelly Silt - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Gravelly Sandy Silt’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Gravelly Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Gravel - Sand - Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Rock - Sand - Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Rock - Gravel - Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Rock - Gravel - Sand’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HT	Rock - Gravel - Sand - Mud’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Gravelly Clay’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘HT	Sand - Clay - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Sandy Clay’	0.2762124	0.2970496	0.1658848	0.1246544	0.0587601	0.0372614	0.0334699	0.0067075	1

‘HT	Coral Debris - Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Coarse Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Very Fine Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘HT	Fine Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘HT	Medium Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘HT	Coarse Silt’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘HT	Rough rock’	0	0	0	0	0	0	0	1	1
‘HT	Mud over Rock’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘HT	Silty Clay - Shell’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘HT	Boulders’	0	0	0	0	0	0	0	1	1
‘HT	Cobbles (Stones) - Shell’	0	0	0	0	0	0	0	1	1
‘HT	Pebbles - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HT	Granules’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Sand - Silt - Clay - Shell’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘HT	Gravel - Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HT	Rock - Gravel - Sand - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HT	Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Rock - Gravel’	0	0	0	0	0	0	0	1	1
‘HT	Rock - Coral’	0	0	0	0	0	0	0	1	1
‘HT	Rock - Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Rock - Mud’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘HT	Mud - Shell’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Gravel - Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Mud - Gravel’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘HT	Clayey Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Soft Mud’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1
‘HT	Hard Mud’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HT	Silty Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Gravelly Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Medium Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Fine Sand - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Sandy Gravel - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HT	Clayey Silt - Shell’	0.0549202	0.1524184	0.1530047	0.180103	0.1254843	0.1099096	0.1574853	0.0666744	1
‘HT	Silt - Shell’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HT	Silty Gravel - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Sandy Silt - Shell’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HT	Sand - Mud’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘HT	Muddy Sand’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘HT	Sandy Mud’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘HT	Mud’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘HT	Clay - Shell’	0.166989	0.2648583	0.1835371	0.1606946	0.0860842	0.0603702	0.0621231	0.0153435	1

‘HT	Stiff Mud’	0.0159293	0.0736871	0.1020173	0.1535139	0.1308641	0.1348693	0.2441906	0.1449285	1
‘HS	Ooze’	0.6214517	0.2454437	0.0762309	0.0367675	0.0115719	0.005262	0.0029948	0.0002775	1
‘HV	Clayey Gravel’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HV	Gravelly Sand’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘HV	Rock - Gravel - Sand - Shell’	0	0	0	0	0.0001216	0.0009473	0.0137268	0.9852043	1
‘HV	Muddy Sand’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘HV	Sandy Mud’	0.0375068	0.1267843	0.1420029	0.1799182	0.1323399	0.1204644	0.1806946	0.0802889	1
‘HV	Mud’	0.0664415	0.1750939	0.1668047	0.1860404	0.1226273	0.1018535	0.1333201	0.0478185	1
‘N	Oceanic Rock Outcrops’	0	0	0	0	0	0	0	1	1
‘N	Continental Rock Outcrops’	0	0	0	0	0	0	0	1	1
‘N	Hard Bottom’	0	0	0	0	0	0	0	1	1
‘A	Marsh’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘A	Mangrove’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘A	Intratidal’	0.1132589	0.2192037	0.1762995	0.1750654	0.1053781	0.08174	0.0978865	0.0311679	1
‘A	Supratidal Zone’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘A	Salt Dome’	0	0	0	0	0	0	0	1	1
‘A	Gypsum’	0	0	0	0	0	0	0	1	1
‘A	Peat’	0.0060333	0.0382362	0.0653298	0.1167655	0.1150811	0.1340442	0.2931471	0.2313629	1
‘A	Rock Outcrop’	0	0	0	0	0	0	0	1	1
‘A	Rubble’	0	0	0	0	0	0	0	1	1
‘A	Man-Made Features’	0	0	0	0	0	0	0	1	1

% This file was used to create the totally uncertain scenario found in Figure 10. It is a text file with extension .dne and is used in the Netica software package. Any scenario can be generated by changing the appropriate variables in this file. The file was provided by Bruce Lin at NRL.

```
// ~->[DNET-1]->~

// File created by an unlicensed user using Netica 4.08 on Jul 03, 2008 at 08:53:13.

bnet impactStates {
AutoCompile = TRUE;
autoupdate = TRUE;
whenchanged = 1214851329;

visual V1 {
	defdispform = LABELBOX;
	nodelabeling = TITLE;
	NodeMaxNumEntries = 50;
	nodefont = font {shape= “Arial”; size= 10;};
	linkfont = font {shape= “Arial”; size= 9;};
	windowposn = (44, 58, 1252, 692);
	resolution = 72;
	drawingbounds = (5998, 754);
	showpagebreaks = FALSE;
	usegrid = TRUE;
	gridspace = (6, 6);
	NodeSet Node {BuiltIn = 1; Color = 0xc0c0c0;};
	NodeSet Nature {BuiltIn = 1; Color = 0xf8eed2;};
	NodeSet Deterministic {BuiltIn = 1; Color = 0xd3caa6;};
	NodeSet Finding {BuiltIn = 1; Color = 0xc8c8c8;};
	NodeSet Constant {BuiltIn = 1; Color = 0xffffff;};
	NodeSet ConstantValue {BuiltIn = 1; Color = 0xffffb4;};
	NodeSet Utility {BuiltIn = 1; Color = 0xffbdbd;};
	NodeSet Decision {BuiltIn = 1; Color = 0xdee8ff;};
	NodeSet Documentation {BuiltIn = 1; Color = 0xf0fafa;};
	NodeSet Title {BuiltIn = 1; Color = 0xffffff;};
	PrinterSetting A {
		margins = (1270, 1270, 1270, 1270);
		landscape = FALSE;
		magnify = 1;
		};
	};

node TI {
	kind = NATURE;
	discrete = FALSE;
	chance = CHANCE;
	states = (Nosedown, Tilted, Horizontal);
	levels = (0, 30, 60, 100);
	parents = ();
	probs =
		// Nosedown     Tilted       Horizontal
		  (0.3333333,   0.3333333,   0.3333333);
	title = “Angle of Release”;
	whenchanged = 1102106404;
	belief = (0.3333333, 0.3333333, 0.3333333);
	visual V1 {
		center = (96, 48);
		dispform = BELIEFBARS;
		height = 4;
		};
	};

node WD {
	kind = NATURE;
	discrete = FALSE;
	chance = CHANCE;
```

```
        states = (Shal8_16, Int16_24m, Deep24_36);
        levels = (8, 16, 24, 32);
        parents = ();
        probs = 
                // Shal8 16     Int16 24m    Deep24 36
                  (0.3333333,   0.3333333,   0.3333333);
        title = “Water Depth”;
        comment = “Water Depth range s slightly extened from NEST-06 field test in 
Baltic”;
        whenchanged = 1157134096;
        belief = (0.3333333, 0.3333333, 0.3333333);
        visual V1 {
                center = (96, 294);
                dispform = BELIEFBARS;
                height = 1;
                };
        };

node MT {
        kind = NATURE;
        discrete = TRUE;
        chance = CHANCE;
        states = (BRM, StoneFish, NRL_MK56, MK36nBomb);
        levels = (1, 2, 3, 4);
        parents = ();
        probs = 
                // BRM          StoneFish    NRL MK56     MK36nBomb
                  (0.25,        0.25,        0.25,        0.25);
        title = “MineType”;
        comment = “MineType specific to NEST-06 field Test where\n\
                CoGoffset range is predetermined for each mine.\n\
                1 = BRM_bal is FWG BRM with CoG between 0 and 1.3 %\n\
                2 = Stonefish Exercise  L = 1.91, D = .52 M = 755 Cog 0 to 5%\n\
                3=NRL is  instrumented mine\”Thumper\” big heavy (L=2.4m \n\
                \|  1070Kg) with Cog ~= 3.7%\n\
                4=MK36nBomb-shaped COG 0–5% L=1.74 D=0.274 m Mass=227 kg”;
        whenchanged = 1157210411;
        belief = (0.25, 0.25, 0.25, 0.25);
        visual V1 {
                center = (102, 156);
                dispform = BELIEFBARS;
                height = 5;
                };
        };

node WT {
        kind = NATURE;
        discrete = FALSE;
        chance = CHANCE;
        states = (Nosedown, to30, to45, to60, to75, Horizontal);
        levels = (0, 15, 30, 45, 60, 75, 90);
        parents = (TI, WD, MT);
        probs = 
                //  Nosedown     to30         to45         to60         to75         
Horizontal       // TI         WD        MT
                ((((0.23,        0.35,        0.37,        0.05,        0,           0),   
// Nosedown   Shal8 16  BRM
                   (0.2,         0.39,        0.37,        0.04,        0,           0),   
// Nosedown   Shal8 16  StoneFish
                   (0.33,        0.39,        0.28,        0,           0,           0),   
// Nosedown   Shal8 16  NRL MK56
                   (0.38,        0.38,        0.24,        0,           0,           0)),  
// Nosedown   Shal8 16  MK36nBomb
                  ((0.24,        0.37,        0.36,        0.03,        0,           0),   
// Nosedown   Int16 24m BRM
                   (0.39,        0.48,        0.13,        0,           0,           0),   
// Nosedown   Int16 24m StoneFish
                   (0.4,         0.5,         0.1,         0,           0,           0),   
// Nosedown   Int16 24m NRL MK56
```

```
                 (0.43,        0.42,        0.15,        0,           0,           0)),
// Nosedown   Int16 24m MK36nBomb
                ((0.28,        0.4,         0.3,         0.02,        0,           0),
// Nosedown   Deep24 36 BRM
                 (0.76,        0.23,        0.01,        0,           0,           0),
// Nosedown   Deep24 36 StoneFish
                 (0.59,        0.41,        0,           0,           0,           0),
// Nosedown   Deep24 36 NRL MK56
                 (0.62,        0.3,         0.08,        0,           0,           0))),
// Nosedown   Deep24 36 MK36nBomb
               (((0,           0,           0.01,        0.41,        0.55,
0.03),          // Tilted     Shal8 16  BRM
                 (0,           0,           0.19,        0.66,        0.15,        0),
// Tilted     Shal8 16  StoneFish
                 (0,           0,           0.2,         0.72,        0.08,        0),
// Tilted     Shal8 16  NRL MK56
                 (0,           0,           0.27,        0.52,        0.21,        0)),
// Tilted     Shal8 16  MK36nBomb
                ((0,           0,           0.05,        0.51,        0.42,
0.02),          // Tilted     Int16 24m BRM
                 (0,           0.21,        0.57,        0.22,        0,           0),
// Tilted     Int16 24m StoneFish
                 (0,           0,           0.67,        0.33,        0,           0),
// Tilted     Int16 24m NRL MK56
                 (0,           0.07,        0.43,        0.38,        0.12,        0)),
// Tilted     Int16 24m MK36nBomb
                ((0,           0,           0.15,        0.55,        0.29,
0.01),          // Tilted     Deep24 36 BRM
                 (0.27,        0.44,        0.28,        0.01,        0,           0),
// Tilted     Deep24 36 StoneFish
                 (0,           0.29,        0.71,        0,           0,           0),
// Tilted     Deep24 36 NRL MK56
                 (0.06,        0.33,        0.31,        0.23,        0.07,        0))),
// Tilted     Deep24 36 MK36nBomb
               (((0,           0,           0,           0,           0.21,
0.79),          // Horizontal Shal8 16  BRM
                 (0,           0,           0.05,        0.44,        0.5,
0.01),          // Horizontal Shal8 16  StoneFish
                 (0,           0,           0,           0.18,        0.82,        0),
// Horizontal Shal8 16  NRL MK56
                 (0,           0,           0,           0.2,         0.54,
0.26)),         // Horizontal Shal8 16  MK36nBomb
                ((0,           0,           0,           0,           0.5,         0.5),
// Horizontal Int16 24m BRM
                 (0,           0.11,        0.46,        0.41,        0.02,        0),
// Horizontal Int16 24m StoneFish
                 (0,           0,           0.02,        0.98,        0,           0),
// Horizontal Int16 24m NRL MK56
                 (0,           0,           0.19,        0.37,        0.3,
0.14)),         // Horizontal Int16 24m MK36nBomb
                ((0,           0,           0,           0.11,        0.55,
0.34),          // Horizontal Deep24 36 BRM
                 (0.21,        0.38,        0.34,        0.07,        0,           0),
// Horizontal Deep24 36 StoneFish
                 (0,           0,           0.88,        0.12,        0,           0),
// Horizontal Deep24 36 NRL MK56
                 (0.02,        0.2,         0.27,        0.23,        0.2,
0.08))));       // Horizontal Deep24 36 MK36nBomb ;
       title = “Sediment Impact Angle”;
       comment = “Angle in degrees that mine impacts the sediment:\n\
              90 is long axis horizontal; 0 is nosedown\n\n\
              7/25/02 values from Monte Carlo of IMPACT28\n\
              ”;
       whenchanged = 1157133928;
       belief = (0.1502778, 0.1847222, 0.2344445, 0.2163889, 0.1536111, 0.06055556);
       visual V1 {
              center = (324, 132);
              dispform = BELIEFBARS;
              height = 7;
```

```
            };
        };

node WVZ {
        kind = NATURE;
        discrete = FALSE;
        chance = CHANCE;
        states = (VerySlow, Slow, Medium, Fast, VeryFast);
        levels = (2, 3, 3.8, 4.4, 5.2, 6);
        parents = (WD, MT, WT);
        probs =
                //  VerySlow     Slow          Medium        Fast          VeryFast
// WD         MT         WT
                ((((0,          0,            0.12,         0.88,         0),
// Shal8 16  BRM       Nosedown
                   (0,          0,            0,            1,            0),
// Shal8 16  BRM       to30
                   (0,          0,            0.6,          0.4,          0),
// Shal8 16  BRM       to45
                   (0,          0.36,         0.64,         0,            0),
// Shal8 16  BRM       to60
                   (0.5,        0.5,          0,            0,            0),
// Shal8 16  BRM       to75
                   (1,          0,            0,            0,            0)),
// Shal8 16  BRM       Horizontal
                  ((0,          0,            0,            0.38,         0.62),
// Shal8 16  StoneFish Nosedown
                   (0,          0,            0,            0.52,         0.48),
// Shal8 16  StoneFish to30
                   (0,          0,            0.16,         0.84,         0),
// Shal8 16  StoneFish to45
                   (0,          0.35,         0.59,         0.06,         0),
// Shal8 16  StoneFish to60
                   (0.49,       0.51,         0,            0,            0),
// Shal8 16  StoneFish to75
                   (1,          0,            0,            0,            0)),
// Shal8 16  StoneFish Horizontal
                  ((0,          0,            0,            0,            1),
// Shal8 16  NRL MK56  Nosedown
                   (0,          0,            0,            0,            1),
// Shal8 16  NRL MK56  to30
                   (0,          0,            0,            0.19,         0.81),
// Shal8 16  NRL MK56  to45
                   (0,          0,            0.4,          0.6,          0),
// Shal8 16  NRL MK56  to60
                   (0,          0.47,         0.53,         0,            0),
// Shal8 16  NRL MK56  to75
                   (0,          0.6,          0.4,          0,            0)),
// Shal8 16  NRL MK56  Horizontal
                  ((0,          0,            0,            0,            1),
// Shal8 16  MK36nBomb Nosedown
                   (0,          0,            0,            0,            1),
// Shal8 16  MK36nBomb to30
                   (0,          0,            0,            0,            1),
// Shal8 16  MK36nBomb to45
                   (0,          0,            0.02,         0.74,         0.24),
// Shal8 16  MK36nBomb to60
                   (0,          0.13,         0.68,         0.19,         0),
// Shal8 16  MK36nBomb to75
                   (0,          0.96,         0.04,         0,            0))),
// Shal8 16  MK36nBomb Horizontal
                 (((0,          0,            0.27,         0.73,         0),
// Int16 24m BRM       Nosedown
                   (0,          0,            0,            1,            0),
// Int16 24m BRM       to30
                   (0,          0,            0.73,         0.27,         0),
// Int16 24m BRM       to45
                   (0,          0.42,         0.58,         0,            0),
// Int16 24m BRM       to60
```

```
                  (0.46,        0.54,        0,           0,           0),
// Int16 24m BRM       to75
                  (1,           0,           0,           0,           0)),
// Int16 24m BRM       Horizontal
                 ((0,           0,           0,           1,           0),
// Int16 24m StoneFish Nosedown
                  (0,           0,           0,           1,           0),
// Int16 24m StoneFish to30
                  (0,           0,           0.11,        0.89,        0),
// Int16 24m StoneFish to45
                  (0,           0.08,        0.86,        0.06,        0),
// Int16 24m StoneFish to60
                  (0,           1,           0,           0,           0),
// Int16 24m StoneFish to75
                  (0.2,         0.8,         0,           0,           0)),
// Int16 24m StoneFish Horizontal
                 ((0,           0,           0,           0,           1),
// Int16 24m NRL MK56  Nosedown
                  (0,           0,           0,           0,           1),
// Int16 24m NRL MK56  to30
                  (0,           0,           0,           0.38,        0.62),
// Int16 24m NRL MK56  to45
                  (0,           0,           0.22,        0.78,        0),
// Int16 24m NRL MK56  to60
                  (0,           0,           1,           0,           0),
// Int16 24m NRL MK56  to75
                  (0,           0.2,         0.8,         0,           0)),
// Int16 24m NRL MK56  Horizontal
                 ((0,           0,           0,           0,           1),
// Int16 24m MK36nBomb Nosedown
                  (0,           0,           0,           0,           1),
// Int16 24m MK36nBomb to30
                  (0,           0,           0,           0,           1),
// Int16 24m MK36nBomb to45
                  (0,           0,           0,           0.69,        0.31),
// Int16 24m MK36nBomb to60
                  (0,           0.01,        0.61,        0.38,        0),
// Int16 24m MK36nBomb to75
                  (0,           0.91,        0.09,        0,           0))),
// Int16 24m MK36nBomb Horizontal
                (((0,           0,           0.25,        0.75,        0),
// Deep24 36 BRM       Nosedown
                  (0,           0,           0,           1,           0),
// Deep24 36 BRM       to30
                  (0,           0,           0.77,        0.23,        0),
// Deep24 36 BRM       to45
                  (0,           0.46,        0.54,        0,           0),
// Deep24 36 BRM       to60
                  (0.32,        0.68,        0,           0,           0),
// Deep24 36 BRM       to75
                  (1,           0,           0,           0,           0)),
// Deep24 36 BRM       Horizontal
                 ((0,           0,           0,           1,           0),
// Deep24 36 StoneFish Nosedown
                  (0,           0,           0,           1,           0),
// Deep24 36 StoneFish to30
                  (0,           0,           0,           1,           0),
// Deep24 36 StoneFish to45
                  (0,           0,           0.59,        0.41,        0),
// Deep24 36 StoneFish to60
                  (0,           0,           0.8,         0.2,         0),
// Deep24 36 StoneFish to75
                  (0,           0,           0.9,         0.1,         0)),
// Deep24 36 StoneFish Horizontal
                 ((0,           0,           0,           0,           1),
// Deep24 36 NRL MK56  Nosedown
                  (0,           0,           0,           0,           1),
// Deep24 36 NRL MK56  to30
```

```
                 (0,          0,          0,          0.34,       0.66),
// Deep24 36 NRL MK56  to45
                 (0,          0,          0,          1,          0),
// Deep24 36 NRL MK56  to60
                 (0,          0,          0.2,        0.8,        0),
// Deep24 36 NRL MK56  to75
                 (0,          0,          0.3,        0.7,        0)),
// Deep24 36 NRL MK56  Horizontal
                ((0,          0,          0,          0,          1),
// Deep24 36 MK36nBomb Nosedown
                 (0,          0,          0,          0,          1),
// Deep24 36 MK36nBomb to30
                 (0,          0,          0,          0,          1),
// Deep24 36 MK36nBomb to45
                 (0,          0,          0,          0.57,       0.43),
// Deep24 36 MK36nBomb to60
                 (0,          0,          0.54,       0.46,       0),
// Deep24 36 MK36nBomb to75
                 (0,          0.84,       0.16,       0,          0))));
// Deep24 36 MK36nBomb Horizontal ;
       title = “Sediment Impact Velocity”;
       comment = “ranges are now 2.0 -> 3.0 m/s for Veryslow\n\
              3.0 to 3.8 for Slow\n\
              3.8to 4.4 m/s for medium\n\
              \|  4.4 to 5.2 m/s for fast\n\
              and 5.2 to 6.0 for VeryFast\n\
              \| based on (adj) modeled velocity range of \n\
              Thumper and BRMs with 32 m water for NEST06\n\
              will be adj values from Monte Carlo of IMPACT28\n\
              (adjusted SMALLER by 20%)”;
       whenchanged = 1157133924;
       belief = (0.08584722, 0.1089722, 0.1551444, 0.3471944, 0.3028417);
       visual V1 {
              center = (324, 276);
              dispform = BELIEFBARS;
              height = 6;
              };
       };

node SS {
       kind = NATURE;
       discrete = FALSE;
       chance = CHANCE;
       states = (VSoft0_2, Soft2_4, MSoft4_6, Med6_9, MStiff9_12, Stiff12_16, Hard16_30,
Rock);
       levels = (0, 2, 4, 6, 9, 12, 16, 30, 99);
       parents = ();
       probs =
              // VSoft0 2     Soft2 4      MSoft4 6     Med6 9       MStiff9 12
Stiff12 16   Hard16 30    Rock
                (0.125,       0.125,       0.125,       0.125,       0.125,       0.125,
0.125,       0.125);
       title = “Shear Strength”;
       comment = “ranges used were\n\
              up to 2 kPa  Very Soft\n\
              2 to 4   Soft\n\
              4 to 6   Mod Soft\n\
              6 to 9    Medium\n\
              9–12    MedStiff\n\
              12–16 Stiff\n\
              16–30 Hard\n\
              Very Hard like Rock means >70 kPa, will be assigned <10% burial”;
       whenchanged = 1141238962;
       belief = (0.125, 0.125, 0.125, 0.125, 0.125, 0.125, 0.125, 0.125);
       visual V1 {
              center = (96, 438);
              dispform = BELIEFBARS;
              height = 2;
              };
```

```
        };

node AreaEndState {
        kind = NATURE;
        discrete = FALSE;
        chance = CHANCE;
        states = (R_0_10, R_10_20, R_20_30, R_30_40, R_40_50, R_50_60, R_60_70, R_70_80,
R_80_90, R90_100);
        levels = (0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100);
        parents = (SS, WVZ, WT, MT);
        probs =
               //   R 0 10       R 10 20      R 20 30      R 30 40      R 40 50      R 50
60      R 60 70      R 70 80      R 80 90      R90 100           // SS          WVZ
WT          MT
                 (((((0,            0,            0,            0.08,        0.32,
0.36,        0.16,         0.05,         0.02,         0.01),            // VSoft0 2
VerySlow Nosedown   BRM
                   (0,            0,            0,            0,            0,
0.13,        0.28,         0.28,         0.19,         0.12),            // VSoft0 2
VerySlow Nosedown   StoneFish
                   (0,            0,            0,            0,            0.14,
0.42,        0.31,         0.08,         0.04,         0.01),            // VSoft0 2
VerySlow Nosedown   NRL MK56
                   (0,            0,            0,            0,            0,            0,
0,           0,            0,            1)),              // VSoft0 2   VerySlow Nosedown
MK36nBomb
                  ((0,            0,            0,            0.01,        0.25,
0.38,        0.19,         0.11,         0.04,         0.02),            // VSoft0 2
VerySlow to30       BRM
                   (0,            0,            0,            0,            0,
0.12,        0.36,         0.29,         0.18,         0.05),            // VSoft0 2
VerySlow to30       StoneFish
                   (0,            0,            0,            0,            0.04,
0.27,        0.31,         0.21,         0.08,         0.09),            // VSoft0 2
VerySlow to30       NRL MK56
                   (0,            0,            0,            0,            0,            0,
0,           0,            0,            1)),              // VSoft0 2   VerySlow to30
MK36nBomb
                  ((0,            0,            0,            0,            0.23,
0.41,        0.21,         0.09,         0.04,         0.02),            // VSoft0 2
VerySlow to45       BRM
                   (0,            0,            0,            0,            0,
0.03,        0.23,         0.27,         0.25,         0.22),            // VSoft0 2
VerySlow to45       StoneFish
                   (0,            0,            0,            0,            0.02,
0.25,        0.33,         0.22,         0.14,         0.04),            // VSoft0 2
VerySlow to45       NRL MK56
                   (0,            0,            0,            0,            0,            0,
0,           0,            0.03,         0.97)),           // VSoft0 2   VerySlow to45
MK36nBomb
                  ((0,            0,            0,            0,            0.25,
0.41,        0.19,         0.09,         0.05,         0.01),            // VSoft0 2
VerySlow to60       BRM
                   (0,            0,            0,            0,            0,
0.05,        0.11,         0.15,         0.22,         0.47),            // VSoft0 2
VerySlow to60       StoneFish
                   (0,            0,            0,            0,            0.01,
0.28,        0.33,         0.23,         0.08,         0.07),            // VSoft0 2
VerySlow to60       NRL MK56
                   (0,            0,            0,            0,            0,            0,
0,           0.01,         0.06,         0.93)),           // VSoft0 2   VerySlow to60
MK36nBomb
                  ((0,            0,            0,            0,            0.31,
0.35,        0.19,         0.1,          0.04,         0.01),            // VSoft0 2
VerySlow to75       BRM
                   (0,            0,            0,            0,            0,
0.15,        0.24,         0.13,         0.14,         0.34),            // VSoft0 2
VerySlow to75       StoneFish
```

```
                   (0,          0,          0,          0,          0.02,
0.43,        0.29,        0.15,        0.07,        0.04),          // VSoft0 2
VerySlow to75       NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0.14,        0.15,        0.71)),          // VSoft0 2   VerySlow to75
MK36nBomb
                  ((0,          0,          0,          0,          0.27,
0.39,        0.22,        0.08,        0.03,        0.01),          // VSoft0 2
VerySlow Horizontal BRM
                   (0,          0,          0,          0,          0.04,
0.16,        0.21,        0.15,        0.1,         0.34),          // VSoft0 2
VerySlow Horizontal StoneFish
                   (0,          0,          0,          0.01,       0.07,
0.35,        0.26,        0.19,        0.08,        0.04),          // VSoft0 2
VerySlow Horizontal NRL MK56
                   (0,          0,          0,          0,          0,
0.03,        0.05,        0.1,         0.2,         0.62))),        // VSoft0 2
VerySlow Horizontal MK36nBomb
                 (((0,          0,          0,          0,          0.13,       0.4,
0.34,        0.08,        0.04,        0.01),          // VSoft0 2   Slow     Nosedown
BRM
                   (0,          0,          0,          0,          0,          0,
0.24,        0.32,        0.27,        0.17),          // VSoft0 2   Slow     Nosedown
StoneFish
                   (0,          0,          0,          0,          0,          0.3,
0.46,        0.2,         0.03,        0.01),          // VSoft0 2   Slow     Nosedown
NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0,           0,           1)),            // VSoft0 2   Slow     Nosedown
MK36nBomb
                  ((0,          0,          0,          0,          0.06,
0.26,        0.39,        0.16,        0.09,        0.04),          // VSoft0 2   Slow
to30       BRM
                   (0,          0,          0,          0,          0,          0,
0.26,        0.3,         0.31,        0.13),          // VSoft0 2   Slow     to30
StoneFish
                   (0,          0,          0,          0,          0,
0.22,        0.35,        0.19,        0.19,        0.05),          // VSoft0 2   Slow
to30       NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0,           0,           1)),            // VSoft0 2   Slow     to30
MK36nBomb
                  ((0,          0,          0,          0,          0.02,
0.41,        0.28,        0.2,         0.07,        0.02),          // VSoft0 2   Slow
to45       BRM
                   (0,          0,          0,          0,          0,          0,
0.06,        0.23,        0.29,        0.42),          // VSoft0 2   Slow     to45
StoneFish
                   (0,          0,          0,          0,          0,
0.12,        0.37,        0.34,        0.11,        0.06),          // VSoft0 2   Slow
to45       NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0,           0,           1)),            // VSoft0 2   Slow     to45
MK36nBomb
                  ((0,          0,          0,          0,          0.02,
0.37,        0.34,        0.15,        0.09,        0.03),          // VSoft0 2   Slow
to60       BRM
                   (0,          0,          0,          0,          0,
0.01,        0.09,        0.13,        0.22,        0.55),          // VSoft0 2   Slow
to60       StoneFish
                   (0,          0,          0,          0,          0,
0.06,        0.39,        0.29,        0.14,        0.12),          // VSoft0 2   Slow
to60       NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0.02,        0.02,        0.96)),         // VSoft0 2   Slow     to60
MK36nBomb
                  ((0,          0,          0,          0,          0.02,
0.35,        0.33,        0.19,        0.06,        0.05),          // VSoft0 2   Slow
to75       BRM
```

```
                   (0,           0,           0,           0,           0,           0,
0.13,        0.2,         0.17,        0.5),              // VSoft0 2   Slow     to75
StoneFish
                   (0,           0,           0,           0,           0,
0.06,        0.37,        0.28,        0.14,        0.15),             // VSoft0 2   Slow
to75      NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0.02,        0.06,        0.92)),            // VSoft0 2   Slow     to75
MK36nBomb
                  ((0,           0,           0,           0,           0,
0.24,        0.42,        0.19,        0.07,        0.08),             // VSoft0 2   Slow
Horizontal BRM
                   (0,           0,           0,           0,           0,           0,
0.1,         0.18,        0.17,        0.55),             // VSoft0 2   Slow
Horizontal StoneFish
                   (0,           0,           0,           0,           0,
0.03,        0.26,        0.31,        0.21,        0.19),             // VSoft0 2   Slow
Horizontal NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0.01,        0.11,        0.88))),           // VSoft0 2   Slow
Horizontal MK36nBomb
                 (((0,           0,           0,           0,           0,
0.25,        0.53,        0.18,        0.03,        0.01),             // VSoft0 2
Medium   Nosedown   BRM
                   (0,           0,           0,           0,           0,           0,
0.06,        0.34,        0.33,        0.27),             // VSoft0 2   Medium   Nosedown
StoneFish
                   (0,           0,           0,           0,           0,
0.06,        0.52,        0.32,        0.1,         0),                // VSoft0 2
Medium   Nosedown   NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0,           0,           1)),               // VSoft0 2   Medium   Nosedown
MK36nBomb
                  ((0,           0,           0,           0,           0,
0.22,        0.37,        0.26,        0.12,        0.03),             // VSoft0 2
Medium   to30       BRM
                   (0,           0,           0,           0,           0,           0,
0.02,        0.38,        0.23,        0.37),             // VSoft0 2   Medium   to30
StoneFish
                   (0,           0,           0,           0,           0,           0.1,
0.39,        0.3,         0.2,         0.01),             // VSoft0 2   Medium   to30
NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0,           0,           1)),               // VSoft0 2   Medium   to30
MK36nBomb
                  ((0,           0,           0,           0,           0,
0.17,        0.38,        0.25,        0.14,        0.06),             // VSoft0 2
Medium   to45       BRM
                   (0,           0,           0,           0,           0,           0,
0,           0.12,        0.25,        0.63),             // VSoft0 2   Medium   to45
StoneFish
                   (0,           0,           0,           0,           0,
0.03,        0.23,        0.41,        0.25,        0.08),             // VSoft0 2
Medium   to45       NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0,           0,           1)),               // VSoft0 2   Medium   to45
MK36nBomb
                  ((0,           0,           0,           0,           0,
0.15,        0.38,        0.27,        0.12,        0.08),             // VSoft0 2
Medium   to60       BRM
                   (0,           0,           0,           0,           0,           0,
0,           0.05,        0.2,         0.75),             // VSoft0 2   Medium   to60
StoneFish
                   (0,           0,           0,           0,           0,
0.01,        0.25,        0.47,        0.16,        0.11),             // VSoft0 2
Medium   to60       NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0,           0.02,        0.98)),            // VSoft0 2   Medium   to60
MK36nBomb
```

```
                  ((0,          0,          0,          0,          0,          0.1,
0.43,        0.26,        0.11,        0.1),          // VSoft0 2   Medium   to75
BRM
                   (0,          0,          0,          0,          0,          0,
0,           0.08,        0.17,        0.75),         // VSoft0 2   Medium   to75
StoneFish
                   (0,          0,          0,          0,          0,          0,
0.18,        0.32,        0.22,        0.28),         // VSoft0 2   Medium   to75
NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0.02,        0.07,        0.91)),        // VSoft0 2   Medium   to75
MK36nBomb
                  ((0,          0,          0,          0,          0,
0.01,        0.28,        0.36,        0.17,      0.18),          // VSoft0 2
Medium   Horizontal BRM
                   (0,          0,          0,          0,          0,          0,
0,           0.08,        0.13,        0.79),         // VSoft0 2   Medium
Horizontal StoneFish
                   (0,          0,          0,          0,          0,          0,
0.03,        0.37,        0.3,         0.3),          // VSoft0 2   Medium
Horizontal NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0,           0.01,        0.99))),       // VSoft0 2   Medium
Horizontal MK36nBomb
                 (((0,          0,          0,          0,          0,
0.04,        0.52,        0.36,        0.07,      0.01),          // VSoft0 2   Fast
Nosedown   BRM
                   (0,          0,          0,          0,          0,          0,
0,           0.18,        0.33,        0.49),         // VSoft0 2   Fast     Nosedown
StoneFish
                   (0,          0,          0,          0,          0,          0,
0.25,        0.48,        0.25,        0.02),         // VSoft0 2   Fast     Nosedown
NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0,           0,           1)),           // VSoft0 2   Fast     Nosedown
MK36nBomb
                  ((0,          0,          0,          0,          0,
0.08,        0.37,        0.35,        0.14,      0.06),          // VSoft0 2   Fast
to30       BRM
                   (0,          0,          0,          0,          0,          0,
0,           0.22,        0.36,        0.42),         // VSoft0 2   Fast     to30
StoneFish
                   (0,          0,          0,          0,          0,          0,
0.3,         0.44,        0.2,         0.06),         // VSoft0 2   Fast     to30
NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0,           0,           1)),           // VSoft0 2   Fast     to30
MK36nBomb
                  ((0,          0,          0,          0,          0,          0,
0.31,        0.4,         0.19,        0.1),          // VSoft0 2   Fast     to45
BRM
                   (0,          0,          0,          0,          0,          0,
0,           0.01,        0.27,        0.72),         // VSoft0 2   Fast     to45
StoneFish
                   (0,          0,          0,          0,          0,          0,
0.15,        0.43,        0.29,        0.13),         // VSoft0 2   Fast     to45
NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,           0,           0,           1)),           // VSoft0 2   Fast     to45
MK36nBomb
                  ((0,          0,          0,          0,          0,
0.03,        0.31,        0.34,        0.18,      0.14),          // VSoft0 2   Fast
to60       BRM
                   (0,          0,          0,          0,          0,          0,
0,           0.02,        0.13,        0.85),         // VSoft0 2   Fast     to60
StoneFish
                   (0,          0,          0,          0,          0,          0,
0.13,        0.28,        0.31,        0.28),         // VSoft0 2   Fast     to60
NRL MK56
```

```
                    (0,           0,            0,            0,            0,            0,
0,            0,            0,            1)),               // VSoft0 2   Fast     to60
MK36nBomb
                   ((0,           0,            0,            0,            0,
0.01,         0.26,         0.29,         0.19,         0.25),              // VSoft0 2   Fast
to75       BRM
                    (0,           0,            0,            0,            0,            0,
0,            0.01,         0.12,         0.87),             // VSoft0 2   Fast     to75
StoneFish
                    (0,           0,            0,            0,            0,            0,
0.01,         0.34,         0.39,         0.26),             // VSoft0 2   Fast     to75
NRL MK56
                    (0,           0,            0,            0,            0,            0,
0,            0,            0.04,         0.96)),            // VSoft0 2   Fast     to75
MK36nBomb
                   ((0,           0,            0,            0,            0,            0,
0.05,         0.28,         0.29,         0.38),             // VSoft0 2   Fast
Horizontal BRM
                    (0,           0,            0,            0,            0,            0,
0,            0,            0.03,         0.97),             // VSoft0 2   Fast
Horizontal StoneFish
                    (0,           0,            0,            0,            0,            0,
0,            0.07,         0.36,         0.57),             // VSoft0 2   Fast
Horizontal NRL MK56
                    (0,           0,            0,            0,            0,            0,
0,            0,            0,            1))),              // VSoft0 2   Fast
Horizontal MK36nBomb
                  (((0,           0,            0,            0,            0,            0,
0.19,         0.58,         0.21,         0.02),             // VSoft0 2   VeryFast Nosedown
BRM
                    (0,           0,            0,            0,            0,            0,
0,            0.02,         0.26,         0.72),             // VSoft0 2   VeryFast Nosedown
StoneFish
                    (0,           0,            0,            0,            0,            0,
0.05,         0.34,         0.57,         0.04),             // VSoft0 2   VeryFast Nosedown
NRL MK56
                    (0,           0,            0,            0,            0,            0,
0,            0,            0,            1)),               // VSoft0 2   VeryFast Nosedown
MK36nBomb
                   ((0,           0,            0,            0,            0,            0,
0.22,         0.5,          0.23,         0.05),             // VSoft0 2   VeryFast to30
BRM
                    (0,           0,            0,            0,            0,            0,
0,            0.01,         0.28,         0.71),             // VSoft0 2   VeryFast to30
StoneFish
                    (0,           0,            0,            0,            0,            0,
0.16,         0.45,         0.33,         0.06),             // VSoft0 2   VeryFast to30
NRL MK56
                    (0,           0,            0,            0,            0,            0,
0,            0,            0,            1)),               // VSoft0 2   VeryFast to30
MK36nBomb
                   ((0,           0,            0,            0,            0,            0,
0.07,         0.45,         0.35,         0.13),             // VSoft0 2   VeryFast to45
BRM
                    (0,           0,            0,            0,            0,            0,
0,            0,            0.11,         0.89),             // VSoft0 2   VeryFast to45
StoneFish
                    (0,           0,            0,            0,            0,            0,
0.02,         0.39,         0.47,         0.12),             // VSoft0 2   VeryFast to45
NRL MK56
                    (0,           0,            0,            0,            0,            0,
0,            0,            0,            1)),               // VSoft0 2   VeryFast to45
MK36nBomb
                   ((0,           0,            0,            0,            0,            0,
0.07,         0.37,         0.3,          0.26),             // VSoft0 2   VeryFast to60
BRM
                    (0,           0,            0,            0,            0,            0,
0,            0,            0.02,         0.98),             // VSoft0 2   VeryFast to60
StoneFish
```

```
               (0,          0,          0,          0,          0,          0,
0.02,       0.3,        0.38,       0.3),           // VSoft0 2   VeryFast to60
NRL MK56
               (0,          0,          0,          0,          0,          0,
0,          0,          0,          1)),            // VSoft0 2   VeryFast to60
MK36nBomb
              ((0,          0,          0,          0,          0,          0,
0.05,       0.23,       0.32,       0.4),           // VSoft0 2   VeryFast to75
BRM
               (0,          0,          0,          0,          0,          0,
0,          0,          0.01,       0.99),          // VSoft0 2   VeryFast to75
StoneFish
               (0,          0,          0,          0,          0,          0,
0,          0.11,       0.39,       0.5),           // VSoft0 2   VeryFast to75
NRL MK56
               (0,          0,          0,          0,          0,          0,
0,          0,          0,          1)),            // VSoft0 2   VeryFast to75
MK36nBomb
              ((0,          0,          0,          0,          0,          0,
0,          0.05,       0.2,        0.75),          // VSoft0 2   VeryFast
Horizontal BRM
               (0,          0,          0,          0,          0,          0,
0,          0,          0,          1),             // VSoft0 2   VeryFast
Horizontal StoneFish
               (0,          0,          0,          0,          0,          0,
0,          0.01,       0.18,       0.81),          // VSoft0 2   VeryFast
Horizontal NRL MK56
               (0,          0,          0,          0,          0,          0,
0,          0,          0,          1)))),          // VSoft0 2   VeryFast
Horizontal MK36nBomb
             ((((0,         0,          0.17,       0.56,       0.24,
0.03,       0,          0,          0,          0),             // Soft2 4
VerySlow Nosedown   BRM
               (0,          0,          0.02,       0.24,       0.43,
0.26,       0.05,       0,          0,          0),             // Soft2 4
VerySlow Nosedown   StoneFish
               (0,          0,          0.01,       0.39,       0.48,       0.1,
0.01,       0.01,       0,          0),             // Soft2 4    VerySlow Nosedown
NRL MK56
               (0,          0,          0,          0,          0,          0,
0.02,       0.06,       0.15,       0.77)),         // Soft2 4    VerySlow Nosedown
MK36nBomb
              ((0,          0,          0.09,       0.51,       0.38,
0.02,       0,          0,          0,          0),             // Soft2 4
VerySlow to30       BRM
               (0,          0,          0,          0.37,       0.39,
0.22,       0.02,       0,          0,          0),             // Soft2 4
VerySlow to30       StoneFish
               (0,          0,          0,          0.3,        0.48,       0.2,
0.02,       0,          0,          0),             // Soft2 4    VerySlow to30
NRL MK56
               (0,          0,          0,          0,          0,          0,
0.07,       0.15,       0.21,       0.57)),         // Soft2 4    VerySlow to30
MK36nBomb
              ((0,          0,          0.03,       0.53,       0.41,
0.03,       0,          0,          0,          0),             // Soft2 4
VerySlow to45       BRM
               (0,          0,          0,          0.27,       0.4,
0.24,       0.09,       0,          0,          0),             // Soft2 4
VerySlow to45       StoneFish
               (0,          0,          0.01,       0.3,        0.51,
0.17,       0.01,       0,          0,          0),             // Soft2 4
VerySlow to45       NRL MK56
               (0,          0,          0,          0,          0,          0,
0.16,       0.24,       0.18,       0.42)),         // Soft2 4    VerySlow to45
MK36nBomb
              ((0,          0,          0.01,       0.63,       0.35,
0.01,       0,          0,          0,          0),             // Soft2 4
VerySlow to60       BRM
```

```
                   (0,          0,          0,          0.15,       0.43,       0.3,
0.1,        0.02,       0,          0),                 // Soft2 4    VerySlow to60
StoneFish
                   (0,          0,          0,          0.22,       0.65,
0.12,       0.01,       0,          0,          0),                 // Soft2 4
VerySlow to60      NRL MK56
                   (0,          0,          0,          0,          0,
0.12,       0.25,       0.2,        0.15,       0.28)),             // Soft2 4
VerySlow to60      MK36nBomb
                  ((0,          0,          0.02,       0.69,       0.27,
0.02,       0,          0,          0,          0),                 // Soft2 4
VerySlow to75      BRM
                   (0,          0,          0,          0.12,       0.53,       0.3,
0.04,       0.01,       0,          0),                 // Soft2 4    VerySlow to75
StoneFish
                   (0,          0,          0,          0.29,       0.6,
0.11,       0,          0,          0,          0),                 // Soft2 4
VerySlow to75      NRL MK56
                   (0,          0,          0,          0,          0,
0.21,       0.32,       0.2,        0.16,       0.11)),             // Soft2 4
VerySlow to75      MK36nBomb
                  ((0,          0,          0.03,       0.56,       0.38,
0.03,       0,          0,          0,          0),                 // Soft2 4
VerySlow Horizontal BRM
                   (0,          0,          0,          0.24,       0.58,
0.18,       0,          0,          0,          0),                 // Soft2 4
VerySlow Horizontal StoneFish
                   (0,          0,          0.01,       0.26,       0.61,
0.12,       0,          0,          0,          0),                 // Soft2 4
VerySlow Horizontal NRL MK56
                   (0,          0,          0.03,       0.07,       0.21,
0.26,       0.19,       0.13,       0.05,       0.06))),            // Soft2 4
VerySlow Horizontal MK36nBomb
                 (((0,          0,          0.01,       0.48,       0.45,
0.05,       0.01,       0,          0,          0),                 // Soft2 4    Slow
Nosedown   BRM
                   (0,          0,          0,          0.02,       0.41,
0.39,       0.17,       0.01,       0,          0),                 // Soft2 4    Slow
Nosedown   StoneFish
                   (0,          0,          0,          0.14,       0.58,
0.25,       0.03,       0,          0,          0),                 // Soft2 4    Slow
Nosedown   NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,          0.03,       0.08,       0.89)),             // Soft2 4    Slow     Nosedown
MK36nBomb
                  ((0,          0,          0,          0.28,       0.57,
0.14,       0.01,       0,          0,          0),                 // Soft2 4    Slow
to30       BRM
                   (0,          0,          0,          0.02,       0.39,
0.45,       0.14,       0,          0,          0),                 // Soft2 4    Slow
to30       StoneFish
                   (0,          0,          0,          0.09,       0.49,
0.36,       0.06,       0,          0,          0),                 // Soft2 4    Slow
to30       NRL MK56
                   (0,          0,          0,          0,          0,          0,
0.01,       0.11,       0.18,       0.7)),              // Soft2 4    Slow     to30
MK36nBomb
                  ((0,          0,          0.01,       0.26,       0.59,
0.14,       0,          0,          0,          0),                 // Soft2 4    Slow
to45       BRM
                   (0,          0,          0,          0.02,       0.37,
0.34,       0.23,       0.04,       0,          0),                 // Soft2 4    Slow
to45       StoneFish
                   (0,          0,          0,          0.05,       0.58,
0.34,       0.01,       0.02,       0,          0),                 // Soft2 4    Slow
to45       NRL MK56
                   (0,          0,          0,          0,          0,          0,
0.03,       0.23,       0.24,       0.5)),              // Soft2 4    Slow     to45
MK36nBomb
```

```
                  ((0,          0,          0,          0.24,       0.66,       0.1,
0,          0,          0,          0),              // Soft2 4    Slow     to60
BRM
                   (0,          0,          0,          0,          0.31,
0.37,       0.23,       0.07,       0.02,       0),              // Soft2 4    Slow
to60       StoneFish
                   (0,          0,          0,          0.03,       0.58,
0.35,       0.04,       0,          0,          0),              // Soft2 4    Slow
to60       NRL MK56
                   (0,          0,          0,          0,          0,
0.01,       0.16,       0.2,        0.15,       0.48)),          // Soft2 4    Slow
to60       MK36nBomb
                  ((0,          0,          0,          0.23,       0.59,
0.18,       0,          0,          0,          0),              // Soft2 4    Slow
to75       BRM
                   (0,          0,          0,          0,          0.29,
0.49,       0.19,       0.03,       0,          0),              // Soft2 4    Slow
to75       StoneFish
                   (0,          0,          0,          0,          0.58,
0.36,       0.06,       0,          0,          0),              // Soft2 4    Slow
to75       NRL MK56
                   (0,          0,          0,          0,          0,
0.05,       0.25,       0.26,       0.13,       0.31)),          // Soft2 4    Slow
to75       MK36nBomb
                  ((0,          0,          0,          0.05,       0.64,       0.3,
0.01,       0,          0,          0),              // Soft2 4    Slow
Horizontal BRM
                   (0,          0,          0,          0,          0.36,
0.47,       0.15,       0.02,       0,          0),              // Soft2 4    Slow
Horizontal StoneFish
                   (0,          0,          0,          0.01,       0.49,
0.45,       0.05,       0,          0,          0),              // Soft2 4    Slow
Horizontal NRL MK56
                   (0,          0,          0,          0,          0.06,
0.13,       0.22,       0.27,       0.16,       0.16))),         // Soft2 4    Slow
Horizontal MK36nBomb
                 (((0,          0,          0,          0.12,       0.61,
0.24,       0.03,       0,          0,          0),              // Soft2 4
Medium   Nosedown   BRM
                   (0,          0,          0,          0,          0.15,       0.5,
0.32,       0.03,       0,          0),              // Soft2 4    Medium   Nosedown
StoneFish
                   (0,          0,          0,          0,          0.42,
0.54,       0.04,       0,          0,          0),              // Soft2 4
Medium   Nosedown   NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,          0,          0.02,       0.98)),          // Soft2 4    Medium   Nosedown
MK36nBomb
                  ((0,          0,          0,          0.17,       0.55,
0.24,       0.04,       0,          0,          0),              // Soft2 4
Medium   to30       BRM
                   (0,          0,          0,          0,          0.19,
0.43,       0.34,       0.04,       0,          0),              // Soft2 4
Medium   to30       StoneFish
                   (0,          0,          0,          0,          0.36,
0.47,       0.17,       0,          0,          0),              // Soft2 4
Medium   to30       NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,          0.03,       0.1,        0.87)),          // Soft2 4    Medium   to30
MK36nBomb
                  ((0,          0,          0,          0.1,        0.57,       0.3,
0.03,       0,          0,          0),              // Soft2 4    Medium   to45
BRM
                   (0,          0,          0,          0,          0.17,
0.42,       0.25,       0.16,       0,          0),              // Soft2 4
Medium   to45       StoneFish
                   (0,          0,          0,          0,          0.33,
0.56,       0.11,       0,          0,          0),              // Soft2 4
Medium   to45       NRL MK56
```

```
                   (0,          0,           0,           0,           0,          0,
0.05,        0.1,         0.26,        0.59)),           // Soft2 4    Medium   to45
MK36nBomb
                  ((0,          0,           0,           0.03,        0.63,
0.32,        0.02,        0,           0,           0),              // Soft2 4
Medium   to60       BRM
                   (0,          0,           0,           0,           0.1,
0.34,        0.3,         0.2,         0.05,        0.01),           // Soft2 4
Medium   to60       StoneFish
                   (0,          0,           0,           0,           0.28,
0.51,        0.21,        0,           0,           0),              // Soft2 4
Medium   to60       NRL MK56
                   (0,          0,           0,           0,           0,          0,
0.1,         0.1,         0.19,        0.61)),           // Soft2 4    Medium   to60
MK36nBomb
                  ((0,          0,           0,           0.01,        0.52,
0.45,        0.02,        0,           0,           0),              // Soft2 4
Medium   to75       BRM
                   (0,          0,           0,           0,           0.07,
0.47,        0.33,        0.11,        0.02,        0),              // Soft2 4
Medium   to75       StoneFish
                   (0,          0,           0,           0,           0.32,
0.54,        0.14,        0,           0,           0),              // Soft2 4
Medium   to75       NRL MK56
                   (0,          0,           0,           0,           0,          0,
0.08,        0.26,        0.2,         0.46)),           // Soft2 4    Medium   to75
MK36nBomb
                  ((0,          0,           0,           0,           0.29,
0.56,        0.15,        0,           0,           0),              // Soft2 4
Medium   Horizontal BRM
                   (0,          0,           0,           0,           0.01,
0.43,        0.37,        0.17,        0.02,        0),              // Soft2 4
Medium   Horizontal StoneFish
                   (0,          0,           0,           0,           0.02,
0.51,        0.41,        0.06,        0,           0),              // Soft2 4
Medium   Horizontal NRL MK56
                   (0,          0,           0,           0,           0,          0,
0.04,        0.21,        0.22,        0.53))),          // Soft2 4    Medium
Horizontal MK36nBomb
                 (((0,          0,           0,           0,           0.45,
0.47,        0.07,        0.01,        0,           0),              // Soft2 4    Fast
Nosedown   BRM
                   (0,          0,           0,           0,           0,
0.37,        0.42,        0.2,         0.01,        0),              // Soft2 4    Fast
Nosedown   StoneFish
                   (0,          0,           0,           0,           0.09,
0.59,        0.3,         0.02,        0,           0),              // Soft2 4    Fast
Nosedown   NRL MK56
                   (0,          0,           0,           0,           0,          0,
0,           0,           0.01,        0.99)),           // Soft2 4    Fast     Nosedown
MK36nBomb
                  ((0,          0,           0,           0,           0.36,
0.49,        0.14,        0.01,        0,           0),              // Soft2 4    Fast
to30       BRM
                   (0,          0,           0,           0,           0.02,
0.31,        0.47,        0.2,         0,           0),              // Soft2 4    Fast
to30       StoneFish
                   (0,          0,           0,           0,           0.28,
0.47,        0.2,         0.05,        0,           0),              // Soft2 4    Fast
to30       NRL MK56
                   (0,          0,           0,           0,           0,          0,
0,           0,           0.05,        0.95)),           // Soft2 4    Fast     to30
MK36nBomb
                  ((0,          0,           0,           0,           0.48,
0.42,        0.09,        0.01,        0,           0),              // Soft2 4    Fast
to45       BRM
                   (0,          0,           0,           0,           0,
0.28,        0.33,        0.33,        0.06,        0),              // Soft2 4    Fast
to45       StoneFish
```

```
                   (0,           0,           0,           0,           0.11,
0.52,        0.32,        0.05,        0,           0),              // Soft2 4    Fast
to45       NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0.06,        0.17,        0.77)),           // Soft2 4    Fast     to45
MK36nBomb
                  ((0,           0,           0,           0,           0.4,
0.49,        0.11,        0,           0,           0),              // Soft2 4    Fast
to60       BRM
                   (0,           0,           0,           0,           0,
0.26,        0.33,        0.29,        0.12,        0),              // Soft2 4    Fast
to60       StoneFish
                   (0,           0,           0,           0,           0.06,
0.46,        0.45,        0.03,        0,           0),              // Soft2 4    Fast
to60       NRL MK56
                   (0,           0,           0,           0,           0,           0,
0.05,        0.16,        0.23,        0.56)),           // Soft2 4    Fast     to60
MK36nBomb
                  ((0,           0,           0,           0,           0.25,
0.56,        0.18,        0.01,        0,           0),              // Soft2 4    Fast
to75       BRM
                   (0,           0,           0,           0,           0,           0.3,
0.42,        0.2,         0.08,        0),               // Soft2 4    Fast     to75
StoneFish
                   (0,           0,           0,           0,           0.03,
0.57,        0.33,        0.07,        0,           0),              // Soft2 4    Fast
to75       NRL MK56
                   (0,           0,           0,           0,           0,           0,
0.04,        0.17,        0.3,         0.49)),           // Soft2 4    Fast     to75
MK36nBomb
                  ((0,           0,           0,           0,           0.02,
0.53,        0.35,        0.1,         0,           0),              // Soft2 4    Fast
Horizontal BRM
                   (0,           0,           0,           0,           0,
0.15,        0.44,        0.23,        0.15,        0.03),           // Soft2 4    Fast
Horizontal StoneFish
                   (0,           0,           0,           0,           0,           0.3,
0.33,        0.3,         0.07,        0),               // Soft2 4    Fast
Horizontal NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0.09,        0.19,        0.72))),          // Soft2 4    Fast
Horizontal MK36nBomb
                 (((0,           0,           0,           0,           0.05,
0.47,        0.43,        0.05,        0,           0),              // Soft2 4
VeryFast Nosedown   BRM
                   (0,           0,           0,           0,           0,
0.04,        0.43,        0.39,        0.13,        0.01),           // Soft2 4
VeryFast Nosedown   StoneFish
                   (0,           0,           0,           0,           0,
0.28,        0.51,        0.19,        0.02,        0),              // Soft2 4
VeryFast Nosedown   NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0,           0,           1)),              // Soft2 4    VeryFast Nosedown
MK36nBomb
                  ((0,           0,           0,           0,           0.1,
0.54,        0.33,        0.03,        0,           0),              // Soft2 4
VeryFast to30       BRM
                   (0,           0,           0,           0,           0,
0.03,        0.49,        0.4,         0.08,        0),              // Soft2 4
VeryFast to30       StoneFish
                   (0,           0,           0,           0,           0,
0.42,        0.44,        0.14,        0,           0),              // Soft2 4
VeryFast to30       NRL MK56
                   (0,           0,           0,           0,           0,           0,
0,           0,           0.01,        0.99)),           // Soft2 4    VeryFast to30
MK36nBomb
                  ((0,           0,           0,           0,           0.1,
0.52,        0.34,        0.04,        0,           0),              // Soft2 4
VeryFast to45       BRM
```

```
                   (0,          0,          0,          0,          0,
0.05,       0.33,       0.35,       0.24,       0.03),          // Soft2 4
VeryFast to45      StoneFish
                   (0,          0,          0,          0,          0,
0.31,       0.54,       0.13,       0.02,       0),             // Soft2 4
VeryFast to45      NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,          0.02,       0.11,       0.87)),         // Soft2 4    VeryFast to45
MK36nBomb
                  ((0,          0,          0,          0,          0.06,
0.55,       0.34,       0.05,       0,          0),             // Soft2 4
VeryFast to60      BRM
                   (0,          0,          0,          0,          0,
0.04,       0.25,       0.35,       0.29,       0.07),          // Soft2 4
VeryFast to60      StoneFish
                   (0,          0,          0,          0,          0,
0.31,       0.45,       0.22,       0.02,       0),             // Soft2 4
VeryFast to60      NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,          0.07,       0.14,       0.79)),         // Soft2 4    VeryFast to60
MK36nBomb
                  ((0,          0,          0,          0,          0,
0.47,       0.37,       0.15,       0.01,       0),             // Soft2 4
VeryFast to75      BRM
                   (0,          0,          0,          0,          0,
0.03,       0.35,       0.29,       0.19,       0.14),          // Soft2 4
VeryFast to75      StoneFish
                   (0,          0,          0,          0,          0,
0.18,       0.41,       0.34,       0.07,       0),             // Soft2 4
VeryFast to75      NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,          0.06,       0.18,       0.76)),         // Soft2 4    VeryFast to75
MK36nBomb
                  ((0,          0,          0,          0,          0,
0.13,       0.47,       0.29,       0.09,       0.02),          // Soft2 4
VeryFast Horizontal BRM
                   (0,          0,          0,          0,          0,          0,
0.16,       0.3,        0.23,       0.31),          // Soft2 4    VeryFast
Horizontal StoneFish
                   (0,          0,          0,          0,          0,
0.02,       0.27,       0.36,       0.28,       0.07),          // Soft2 4
VeryFast Horizontal NRL MK56
                   (0,          0,          0,          0,          0,          0,
0,          0,          0.04,       0.96)))),       // Soft2 4    VeryFast
Horizontal MK36nBomb
                 ((((0,         0.11,       0.72,       0.17,       0,          0,
0,          0,          0,          0),             // MSoft4 6   VerySlow Nosedown
BRM
                   (0,          0.01,       0.34,       0.61,       0.04,       0,
0,          0,          0,          0),             // MSoft4 6   VerySlow Nosedown
StoneFish
                   (0,          0.02,       0.57,       0.39,       0.02,       0,
0,          0,          0,          0),             // MSoft4 6   VerySlow Nosedown
NRL MK56
                   (0,          0,          0,          0,          0,
0.05,       0.23,       0.37,       0.27,       0.08)),         // MSoft4 6
VerySlow Nosedown  MK36nBomb
                  ((0,          0,          0.6,        0.4,        0,          0,
0,          0,          0,          0),             // MSoft4 6   VerySlow to30
BRM
                   (0,          0,          0.61,       0.39,       0,          0,
0,          0,          0,          0),             // MSoft4 6   VerySlow to30
StoneFish
                   (0,          0,          0.51,       0.47,       0.02,       0,
0,          0,          0,          0),             // MSoft4 6   VerySlow to30
NRL MK56
                   (0,          0,          0,          0,          0.01,       0.2,
0.32,       0.29,       0.16,       0.02)),         // MSoft4 6   VerySlow to30
MK36nBomb
```

```
                  ((0,          0,          0.5,        0.5,        0,          0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow to45
BRM
                   (0,          0,          0.47,       0.51,       0.02,       0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow to45
StoneFish
                   (0,          0,          0.42,       0.5,        0.08,       0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow to45
NRL MK56
                   (0,          0,          0,          0,          0.06,
0.44,       0.29,       0.17,       0.04,       0)),              // MSoft4 6
VerySlow to45       MK36nBomb
                  ((0,          0,          0.52,       0.48,       0,          0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow to60
BRM
                   (0,          0,          0.31,       0.61,       0.08,       0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow to60
StoneFish
                   (0,          0,          0.28,       0.67,       0.05,       0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow to60
NRL MK56
                   (0,          0,          0,          0,          0.14,       0.5,
0.22,       0.1,        0.04,       0)),                // MSoft4 6   VerySlow to60
MK36nBomb
                  ((0,          0,          0.58,       0.42,       0,          0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow to75
BRM
                   (0,          0,          0.03,       0.76,       0.2,
0.01,       0,          0,          0,          0),               // MSoft4 6
VerySlow to75       StoneFish
                   (0,          0,          0.18,       0.81,       0.01,       0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow to75
NRL MK56
                   (0,          0,          0,          0,          0.31,
0.45,       0.16,       0.08,       0,          0)),              // MSoft4 6
VerySlow to75       MK36nBomb
                  ((0,          0.01,       0.38,       0.61,       0,          0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow
Horizontal BRM
                   (0,          0,          0.1,        0.84,       0.06,       0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow
Horizontal StoneFish
                   (0,          0,          0.15,       0.79,       0.06,       0,
0,          0,          0,          0),                 // MSoft4 6   VerySlow
Horizontal NRL MK56
                   (0,          0.03,       0.19,       0.22,       0.27,
0.24,       0.05,       0,          0,          0))),             // MSoft4 6
VerySlow Horizontal MK36nBomb
                 (((0,          0,          0.48,       0.49,       0.03,       0,
0,          0,          0,          0),                 // MSoft4 6   Slow     Nosedown
BRM
                   (0,          0,          0.06,       0.69,       0.25,       0,
0,          0,          0,          0),                 // MSoft4 6   Slow     Nosedown
StoneFish
                   (0,          0,          0.13,       0.73,       0.14,       0,
0,          0,          0,          0),                 // MSoft4 6   Slow     Nosedown
NRL MK56
                   (0,          0,          0,          0,          0,
0.01,       0.07,       0.26,       0.32,       0.34)),           // MSoft4 6   Slow
Nosedown   MK36nBomb
                  ((0,          0,          0.3,        0.65,       0.05,       0,
0,          0,          0,          0),                 // MSoft4 6   Slow     to30
BRM
                   (0,          0,          0.05,       0.77,       0.18,       0,
0,          0,          0,          0),                 // MSoft4 6   Slow     to30
StoneFish
                   (0,          0,          0.03,       0.84,       0.13,       0,
0,          0,          0,          0),                 // MSoft4 6   Slow     to30
NRL MK56
```

```
                    (0,           0,           0,           0,           0,
0.06,        0.25,        0.39,        0.2,         0.1)),            // MSoft4 6   Slow
to30       MK36nBomb
                   ((0,           0,           0.16,        0.81,        0.03,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow     to45
BRM
                    (0,           0,           0.05,        0.8,         0.14,
0.01,        0,           0,           0,           0),               // MSoft4 6   Slow
to45       StoneFish
                    (0,           0,           0.06,        0.76,        0.18,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow     to45
NRL MK56
                    (0,           0,           0,           0,           0,
0.21,        0.34,        0.28,        0.15,        0.02)),           // MSoft4 6   Slow
to45       MK36nBomb
                   ((0,           0,           0.07,        0.91,        0.02,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow     to60
BRM
                    (0,           0,           0.03,        0.69,        0.28,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow     to60
StoneFish
                    (0,           0,           0.01,        0.83,        0.16,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow     to60
NRL MK56
                    (0,           0,           0,           0,           0.03,        0.4,
0.25,        0.15,        0.15,        0.02)),              // MSoft4 6   Slow     to60
MK36nBomb
                   ((0,           0,           0,           0.98,        0.02,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow     to75
BRM
                    (0,           0,           0,           0.35,        0.62,
0.03,        0,           0,           0,           0),               // MSoft4 6   Slow
to75       StoneFish
                    (0,           0,           0,           0.66,        0.34,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow     to75
NRL MK56
                    (0,           0,           0,           0,           0.04,        0.5,
0.35,        0.1,         0.01,        0)),                 // MSoft4 6   Slow     to75
MK36nBomb
                   ((0,           0,           0,           0.84,        0.16,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow
Horizontal BRM
                    (0,           0,           0,           0.36,        0.64,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow
Horizontal StoneFish
                    (0,           0.01,        0,           0.48,        0.51,        0,
0,           0,           0,           0),                  // MSoft4 6   Slow
Horizontal NRL MK56
                    (0,           0,           0.03,        0.12,        0.3,
0.32,        0.18,        0.04,        0.01,        0))),             // MSoft4 6   Slow
Horizontal MK36nBomb
                  (((0,           0,           0.05,        0.89,        0.06,        0,
0,           0,           0,           0),                  // MSoft4 6   Medium   Nosedown
BRM
                    (0,           0,           0,           0.41,        0.57,
0.02,        0,           0,           0,           0),               // MSoft4 6
Medium   Nosedown   StoneFish
                    (0,           0,           0,           0.7,         0.29,
0.01,        0,           0,           0,           0),               // MSoft4 6
Medium   Nosedown   NRL MK56
                    (0,           0,           0,           0,           0,           0,
0.03,        0.1,         0.29,        0.58)),              // MSoft4 6   Medium   Nosedown
MK36nBomb
                   ((0,           0,           0.09,        0.8,         0.11,        0,
0,           0,           0,           0),                  // MSoft4 6   Medium   to30
BRM
                    (0,           0,           0,           0.44,        0.54,
0.02,        0,           0,           0,           0),               // MSoft4 6
Medium   to30       StoneFish
```

```
                    (0,           0,            0,            0.62,         0.38,         0,
0,            0,            0,            0),                 // MSoft4 6   Medium   to30
NRL MK56
                    (0,           0,            0,            0,            0,            0,
0.09,         0.27,         0.44,         0.2)),              // MSoft4 6   Medium   to30
MK36nBomb
                   ((0,           0,            0.08,         0.78,         0.14,         0,
0,            0,            0,            0),                 // MSoft4 6   Medium   to45
BRM
                    (0,           0,            0,            0.48,         0.49,
0.03,         0,            0,            0,            0),                 // MSoft4 6
Medium   to45       StoneFish
                    (0,           0,            0,            0.45,         0.55,         0,
0,            0,            0,            0),                 // MSoft4 6   Medium   to45
NRL MK56
                    (0,           0,            0,            0,            0,
0.08,         0.32,         0.29,         0.27,         0.04)),             // MSoft4 6
Medium   to45       MK36nBomb
                   ((0,           0,            0.01,         0.79,         0.2,          0,
0,            0,            0,            0),                 // MSoft4 6   Medium   to60
BRM
                    (0,           0,            0,            0.32,         0.6,
0.08,         0,            0,            0,            0),                 // MSoft4 6
Medium   to60       StoneFish
                    (0,           0,            0,            0.43,         0.57,         0,
0,            0,            0,            0),                 // MSoft4 6   Medium   to60
NRL MK56
                    (0,           0,            0,            0,            0,
0.17,         0.39,         0.25,         0.14,         0.05)),             // MSoft4 6
Medium   to60       MK36nBomb
                   ((0,           0,            0,            0.68,         0.32,         0,
0,            0,            0,            0),                 // MSoft4 6   Medium   to75
BRM
                    (0,           0,            0,            0.04,         0.84,
0.12,         0,            0,            0,            0),                 // MSoft4 6
Medium   to75       StoneFish
                    (0,           0,            0,            0.34,         0.66,         0,
0,            0,            0,            0),                 // MSoft4 6   Medium   to75
NRL MK56
                    (0,           0,            0,            0,            0,
0.24,         0.43,         0.2,          0.11,         0.02)),             // MSoft4 6
Medium   to75       MK36nBomb
                   ((0,           0,            0,            0.28,         0.72,         0,
0,            0,            0,            0),                 // MSoft4 6   Medium
Horizontal BRM
                    (0,           0,            0,            0.02,         0.83,
0.15,         0,            0,            0,            0),                 // MSoft4 6
Medium   Horizontal StoneFish
                    (0,           0,            0,            0.03,         0.91,
0.06,         0,            0,            0,            0),                 // MSoft4 6
Medium   Horizontal NRL MK56
                    (0,           0,            0.01,         0.01,         0.1,
0.26,         0.41,         0.18,         0.03,         0))),               // MSoft4 6
Medium   Horizontal MK36nBomb
                  (((0,           0,            0,            0.61,         0.39,         0,
0,            0,            0,            0),                 // MSoft4 6   Fast     Nosedown
BRM
                    (0,           0,            0,            0.04,         0.71,
0.25,         0,            0,            0,            0),                 // MSoft4 6   Fast
Nosedown   StoneFish
                    (0,           0,            0,            0.13,         0.82,
0.05,         0,            0,            0,            0),                 // MSoft4 6   Fast
Nosedown   NRL MK56
                    (0,           0,            0,            0,            0,            0,
0.01,         0.06,         0.2,          0.73)),             // MSoft4 6   Fast     Nosedown
MK36nBomb
                   ((0,           0,            0,            0.65,         0.35,         0,
0,            0,            0,            0),                 // MSoft4 6   Fast     to30
BRM
```

```
                    (0,          0,          0,          0.11,       0.66,
0.23,       0,          0,          0,          0),                 // MSoft4 6   Fast
to30       StoneFish
                    (0,          0,          0,          0.27,       0.62,
0.11,       0,          0,          0,          0),                 // MSoft4 6   Fast
to30       NRL MK56
                    (0,          0,          0,          0,          0,          0,
0.12,       0.19,       0.35,       0.34)),          // MSoft4 6   Fast     to30
MK36nBomb
                   ((0,          0,          0,          0.6,        0.4,        0,
0,          0,          0,          0),              // MSoft4 6   Fast     to45
BRM
                    (0,          0,          0,          0.13,       0.64,
0.23,       0,          0,          0,          0),                 // MSoft4 6   Fast
to45       StoneFish
                    (0,          0,          0,          0.14,       0.81,
0.05,       0,          0,          0,          0),                 // MSoft4 6   Fast
to45       NRL MK56
                    (0,          0,          0,          0,          0,
0.01,       0.25,       0.29,       0.32,       0.13)),             // MSoft4 6   Fast
to45       MK36nBomb
                   ((0,          0,          0,          0.43,       0.57,       0,
0,          0,          0,          0),              // MSoft4 6   Fast     to60
BRM
                    (0,          0,          0,          0.05,       0.56,
0.34,       0.05,       0,          0,          0),                 // MSoft4 6   Fast
to60       StoneFish
                    (0,          0,          0,          0.17,       0.77,
0.06,       0,          0,          0,          0),                 // MSoft4 6   Fast
to60       NRL MK56
                    (0,          0,          0,          0,          0,
0.06,       0.37,       0.31,       0.19,       0.07)),             // MSoft4 6   Fast
to60       MK36nBomb
                   ((0,          0,          0,          0.15,       0.84,
0.01,       0,          0,          0,          0),                 // MSoft4 6   Fast
to75       BRM
                    (0,          0,          0,          0,          0.55,
0.45,       0,          0,          0,          0),                 // MSoft4 6   Fast
to75       StoneFish
                    (0,          0,          0,          0.02,       0.73,
0.25,       0,          0,          0,          0),                 // MSoft4 6   Fast
to75       NRL MK56
                    (0,          0,          0,          0,          0,
0.04,       0.34,       0.38,       0.19,       0.05)),             // MSoft4 6   Fast
to75       MK36nBomb
                   ((0,          0,          0,          0,          0.85,
0.15,       0,          0,          0,          0),                 // MSoft4 6   Fast
Horizontal BRM
                    (0,          0,          0,          0,          0.38,       0.6,
0.02,       0,          0,          0),              // MSoft4 6   Fast
Horizontal StoneFish
                    (0,          0,          0,          0,          0.45,
0.55,       0,          0,          0,          0),                 // MSoft4 6   Fast
Horizontal NRL MK56
                    (0,          0,          0,          0,          0,
0.07,       0.29,       0.4,        0.19,       0.05))),            // MSoft4 6   Fast
Horizontal MK36nBomb
                  (((0,          0,          0,          0.06,       0.77,
0.17,       0,          0,          0,          0),                 // MSoft4 6
VeryFast Nosedown   BRM
                    (0,          0,          0,          0,          0.23,
0.66,       0.11,       0,          0,          0),                 // MSoft4 6
VeryFast Nosedown   StoneFish
                    (0,          0,          0,          0,          0.48,       0.5,
0.02,       0,          0,          0),              // MSoft4 6   VeryFast Nosedown
NRL MK56
                    (0,          0,          0,          0,          0,          0,
0,          0,          0.07,       0.93)),          // MSoft4 6   VeryFast Nosedown
MK36nBomb
```

```
                 ((0,          0,           0,           0.14,        0.76,        0.1,
0,           0,           0,           0),             // MSoft4 6   VeryFast to30
BRM
                  (0,          0,           0,           0,           0.28,
0.62,        0.1,         0,           0,           0),             // MSoft4 6
VeryFast to30       StoneFish
                  (0,          0,           0,           0.04,        0.66,        0.3,
0,           0,           0,           0),             // MSoft4 6   VeryFast to30
NRL MK56
                  (0,          0,           0,           0,           0,           0,
0,           0.11,        0.26,        0.63)),         // MSoft4 6   VeryFast to30
MK36nBomb
                 ((0,          0,           0,           0.14,        0.8,
0.06,        0,           0,           0,           0),             // MSoft4 6
VeryFast to45       BRM
                  (0,          0,           0,           0,           0.33,
0.55,        0.11,        0.01,        0,           0),             // MSoft4 6
VeryFast to45       StoneFish
                  (0,          0,           0,           0,           0.66,
0.33,        0.01,        0,           0,           0),             // MSoft4 6
VeryFast to45       NRL MK56
                  (0,          0,           0,           0,           0,           0,
0.04,        0.31,        0.25,        0.4)),          // MSoft4 6   VeryFast to45
MK36nBomb
                 ((0,          0,           0,           0.07,        0.86,
0.07,        0,           0,           0,           0),             // MSoft4 6
VeryFast to60       BRM
                  (0,          0,           0,           0,           0.29,
0.53,        0.18,        0,           0,           0),             // MSoft4 6
VeryFast to60       StoneFish
                  (0,          0,           0,           0,           0.57,
0.42,        0.01,        0,           0,           0),             // MSoft4 6
VeryFast to60       NRL MK56
                  (0,          0,           0,           0,           0,
0.02,        0.17,        0.34,        0.25,        0.22)),         // MSoft4 6
VeryFast to60       MK36nBomb
                 ((0,          0,           0,           0,           0.64,
0.36,        0,           0,           0,           0),             // MSoft4 6
VeryFast to75       BRM
                  (0,          0,           0,           0,           0.1,
0.72,        0.18,        0,           0,           0),             // MSoft4 6
VeryFast to75       StoneFish
                  (0,          0,           0,           0,           0.32,
0.61,        0.07,        0,           0,           0),             // MSoft4 6
VeryFast to75       NRL MK56
                  (0,          0,           0,           0,           0,
0.01,        0.13,        0.42,        0.21,        0.23)),         // MSoft4 6
VeryFast to75       MK36nBomb
                 ((0,          0,           0,           0,           0.22,
0.72,        0.06,        0,           0,           0),             // MSoft4 6
VeryFast Horizontal BRM
                  (0,          0,           0,           0,           0,
0.52,        0.44,        0.04,        0,           0),             // MSoft4 6
VeryFast Horizontal StoneFish
                  (0,          0,           0,           0,           0.04,        0.6,
0.34,        0.02,        0,           0),             // MSoft4 6   VeryFast
Horizontal NRL MK56
                  (0,          0,           0,           0,           0,           0,
0.06,        0.24,        0.35,        0.35)))),       // MSoft4 6   VeryFast
Horizontal MK36nBomb
                ((((0,         0.55,        0.44,        0.01,        0,           0,
0,           0,           0,           0),             // Med6 9     VerySlow Nosedown
BRM
                  (0,          0.11,        0.8,         0.09,        0,           0,
0,           0,           0,           0),             // Med6 9     VerySlow Nosedown
StoneFish
                  (0,          0.38,        0.6,         0.02,        0,           0,
0,           0,           0,           0),             // Med6 9     VerySlow Nosedown
NRL MK56
```

```
                    (0,           0,           0,           0,           0.11,
0.42,        0.38,        0.09,        0,           0)),              // Med6 9
VerySlow Nosedown   MK36nBomb
                   ((0,           0.35,        0.6,         0.05,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to30
BRM
                    (0,           0.34,        0.66,        0,           0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to30
StoneFish
                    (0,           0.36,        0.58,        0.06,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to30
NRL MK56
                    (0,           0,           0,           0,           0.32,
0.41,        0.25,        0.02,        0,           0)),              // Med6 9
VerySlow to30       MK36nBomb
                   ((0,           0.28,        0.66,        0.06,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to45
BRM
                    (0,           0.21,        0.79,        0,           0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to45
StoneFish
                    (0,           0.19,        0.69,        0.12,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to45
NRL MK56
                    (0,           0,           0,           0.03,        0.54,
0.29,        0.12,        0.02,        0,           0)),              // Med6 9
VerySlow to45       MK36nBomb
                   ((0,           0.12,        0.85,        0.03,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to60
BRM
                    (0,           0.09,        0.85,        0.06,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to60
StoneFish
                    (0,           0.08,        0.72,        0.2,         0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to60
NRL MK56
                    (0,           0,           0,           0.05,        0.7,
0.18,        0.07,        0,           0,           0)),              // Med6 9
VerySlow to60       MK36nBomb
                   ((0,           0.01,        0.98,        0.01,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to75
BRM
                    (0,           0,           0.58,        0.42,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to75
StoneFish
                    (0,           0.01,        0.9,         0.09,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow to75
NRL MK56
                    (0,           0,           0,           0.22,        0.63,
0.13,        0.02,        0,           0,           0)),              // Med6 9
VerySlow to75       MK36nBomb
                   ((0,           0.03,        0.92,        0.05,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow
Horizontal BRM
                    (0,           0.01,        0.64,        0.35,        0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow
Horizontal StoneFish
                    (0,           0.03,        0.67,        0.3,         0,           0,
0,           0,           0,           0),                // Med6 9    VerySlow
Horizontal NRL MK56
                    (0.01,        0.18,        0.24,        0.25,        0.29,
0.03,        0,           0,           0,           0))),             // Med6 9
VerySlow Horizontal MK36nBomb
                  (((0,           0.11,        0.85,        0.04,        0,           0,
0,           0,           0,           0),                // Med6 9    Slow     Nosedown
BRM
                    (0,           0,           0.76,        0.24,        0,           0,
0,           0,           0,           0),                // Med6 9    Slow     Nosedown
StoneFish
```

```
              (0,         0.01,       0.86,       0.13,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     Nosedown
NRL MK56
              (0,         0,          0,          0,          0.01,
0.17,       0.41,       0.35,       0.06,       0)),                // Med6 9    Slow
Nosedown   MK36nBomb
             ((0,         0.06,       0.81,       0.13,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to30
BRM
              (0,         0,          0.86,       0.14,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to30
StoneFish
              (0,         0,          0.78,       0.22,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to30
NRL MK56
              (0,         0,          0,          0,          0.05,
0.38,       0.43,       0.13,       0.01,       0)),                // Med6 9    Slow
to30       MK36nBomb
             ((0,         0.03,       0.73,       0.24,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to45
BRM
              (0,         0,          0.86,       0.14,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to45
StoneFish
              (0,         0,          0.66,       0.34,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to45
NRL MK56
              (0,         0,          0,          0,          0.28,
0.41,       0.24,       0.07,       0,          0)),                // Med6 9    Slow
to45       MK36nBomb
             ((0,         0.01,       0.7,        0.29,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to60
BRM
              (0,         0,          0.71,       0.29,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to60
StoneFish
              (0,         0,          0.46,       0.54,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to60
NRL MK56
              (0,         0,          0,          0.01,       0.46,
0.35,       0.14,       0.04,       0,          0)),                // Med6 9    Slow
to60       MK36nBomb
             ((0,         0,          0.69,       0.31,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to75
BRM
              (0,         0,          0.11,       0.85,       0.04,       0,
0,          0,          0,          0),                 // Med6 9    Slow     to75
StoneFish
              (0,         0,          0.25,       0.75,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow     to75
NRL MK56
              (0,         0,          0,          0,          0.52,
0.37,       0.11,       0,          0,          0)),                // Med6 9    Slow
to75       MK36nBomb
             ((0,         0,          0.37,       0.63,       0,          0,
0,          0,          0,          0),                 // Med6 9    Slow
Horizontal BRM
              (0,         0,          0.07,       0.92,       0.01,       0,
0,          0,          0,          0),                 // Med6 9    Slow
Horizontal StoneFish
              (0,         0,          0.09,       0.89,       0.02,       0,
0,          0,          0,          0),                 // Med6 9    Slow
Horizontal NRL MK56
              (0,         0.04,       0.18,       0.21,       0.31,
0.23,       0.03,       0,          0,          0))),               // Med6 9    Slow
Horizontal MK36nBomb
            (((0,         0,          0.88,       0.12,       0,          0,
0,          0,          0,          0),                 // Med6 9    Medium   Nosedown
BRM
```

```
                   (0,           0,           0.37,        0.62,        0.01,        0,
0,           0,           0,           0),                   // Med6 9     Medium   Nosedown
StoneFish
                   (0,           0,           0.57,        0.42,        0.01,        0,
0,           0,           0,           0),                   // Med6 9     Medium   Nosedown
NRL MK56
                   (0,           0,           0,           0,           0,
0.04,        0.26,        0.43,        0.25,        0.02)),              // Med6 9
Medium   Nosedown   MK36nBomb
                  ((0,           0,           0.8,         0.2,         0,           0,
0,           0,           0,           0),                   // Med6 9     Medium   to30
BRM
                   (0,           0,           0.46,        0.54,        0,           0,
0,           0,           0,           0),                   // Med6 9     Medium   to30
StoneFish
                   (0,           0,           0.5,         0.5,         0,           0,
0,           0,           0,           0),                   // Med6 9     Medium   to30
NRL MK56
                   (0,           0,           0,           0,           0,
0.27,        0.41,        0.27,        0.05,        0)),                 // Med6 9
Medium   to30       MK36nBomb
                  ((0,           0,           0.58,        0.42,        0,           0,
0,           0,           0,           0),                   // Med6 9     Medium   to45
BRM
                   (0,           0,           0.49,        0.51,        0,           0,
0,           0,           0,           0),                   // Med6 9     Medium   to45
StoneFish
                   (0,           0,           0.34,        0.65,        0.01,        0,
0,           0,           0,           0),                   // Med6 9     Medium   to45
NRL MK56
                   (0,           0,           0,           0,           0.1,         0.5,
0.31,        0.09,        0,           0)),                  // Med6 9     Medium   to45
MK36nBomb
                  ((0,           0,           0.29,        0.71,        0,           0,
0,           0,           0,           0),                   // Med6 9     Medium   to60
BRM
                   (0,           0,           0.29,        0.67,        0.04,        0,
0,           0,           0,           0),                   // Med6 9     Medium   to60
StoneFish
                   (0,           0,           0.19,        0.8,         0.01,        0,
0,           0,           0,           0),                   // Med6 9     Medium   to60
NRL MK56
                   (0,           0,           0,           0,           0.17,
0.57,        0.21,        0.05,        0,           0)),                 // Med6 9
Medium   to60       MK36nBomb
                  ((0,           0,           0.25,        0.75,        0,           0,
0,           0,           0,           0),                   // Med6 9     Medium   to75
BRM
                   (0,           0,           0.01,        0.79,        0.2,         0,
0,           0,           0,           0),                   // Med6 9     Medium   to75
StoneFish
                   (0,           0,           0.02,        0.9,         0.08,        0,
0,           0,           0,           0),                   // Med6 9     Medium   to75
NRL MK56
                   (0,           0,           0,           0,           0.16,
0.58,        0.22,        0.04,        0,           0)),                 // Med6 9
Medium   to75       MK36nBomb
                  ((0,           0,           0,           0.98,        0.02,        0,
0,           0,           0,           0),                   // Med6 9     Medium
Horizontal BRM
                   (0,           0,           0,           0.73,        0.27,        0,
0,           0,           0,           0),                   // Med6 9     Medium
Horizontal StoneFish
                   (0,           0,           0.01,        0.77,        0.22,        0,
0,           0,           0,           0),                   // Med6 9     Medium
Horizontal NRL MK56
                   (0,           0,           0.02,        0.21,        0.3,
0.36,        0.11,        0,           0,           0))),                // Med6 9
Medium   Horizontal MK36nBomb
```

```
              (((0,          0,          0.41,       0.59,       0,          0,
0,            0,             0,          0),                 // Med6 9    Fast     Nosedown
BRM
               (0,           0,          0.02,       0.88,       0.1,        0,
0,            0,             0,          0),                 // Med6 9    Fast     Nosedown
StoneFish
               (0,           0,          0.1,        0.83,       0.07,       0,
0,            0,             0,          0),                 // Med6 9    Fast     Nosedown
NRL MK56
               (0,           0,          0,          0,          0,
0.01,         0.12,          0.32,       0.4,        0.15)),             // Med6 9     Fast
Nosedown   MK36nBomb
              ((0,           0,          0.49,       0.5,        0.01,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to30
BRM
               (0,           0,          0.08,       0.84,       0.08,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to30
StoneFish
               (0,           0,          0.15,       0.82,       0.03,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to30
NRL MK56
               (0,           0,          0,          0,          0,
0.09,         0.47,          0.31,       0.12,       0.01)),             // Med6 9     Fast
to30       MK36nBomb
              ((0,           0,          0.34,       0.65,       0.01,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to45
BRM
               (0,           0,          0.16,       0.77,       0.07,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to45
StoneFish
               (0,           0,          0.09,       0.83,       0.08,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to45
NRL MK56
               (0,           0,          0,          0,          0.01,
0.33,         0.42,          0.22,       0.02,       0)),                // Med6 9     Fast
to45       MK36nBomb
              ((0,           0,          0.1,        0.88,       0.02,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to60
BRM
               (0,           0,          0.05,       0.79,       0.16,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to60
StoneFish
               (0,           0,          0.03,       0.88,       0.09,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to60
NRL MK56
               (0,           0,          0,          0,          0.03,
0.49,         0.31,          0.14,       0.03,       0)),                // Med6 9     Fast
to60       MK36nBomb
              ((0,           0,          0,          0.95,       0.05,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to75
BRM
               (0,           0,          0,          0.47,       0.52,
0.01,         0,             0,          0,          0),                 // Med6 9     Fast
to75       StoneFish
               (0,           0,          0.01,       0.65,       0.34,       0,
0,            0,             0,          0),                 // Med6 9    Fast     to75
NRL MK56
               (0,           0,          0,          0,          0.02,
0.44,         0.42,          0.1,        0.02,       0)),                // Med6 9     Fast
to75       MK36nBomb
              ((0,           0,          0,          0.66,       0.34,       0,
0,            0,             0,          0),                 // Med6 9    Fast
Horizontal BRM
               (0,           0,          0,          0.2,        0.79,
0.01,         0,             0,          0,          0),                 // Med6 9     Fast
Horizontal StoneFish
               (0,           0,          0,          0.22,       0.77,
0.01,         0,             0,          0,          0),                 // Med6 9     Fast
Horizontal NRL MK56
```

```
                  (0,          0,          0,          0.07,       0.2,
0.31,       0.33,       0.08,       0.01,       0))),          // Med6 9     Fast
Horizontal MK36nBomb
                 (((0,         0,          0.02,       0.83,       0.15,       0,
0,          0,          0,          0),                // Med6 9     VeryFast Nosedown
BRM
                  (0,          0,          0,          0.34,       0.62,
0.04,       0,          0,          0,          0),            // Med6 9
VeryFast Nosedown   StoneFish
                  (0,          0,          0,          0.53,       0.46,
0.01,       0,          0,          0,          0),            // Med6 9
VeryFast Nosedown   NRL MK56
                  (0,          0,          0,          0,          0,          0,
0.02,       0.15,       0.28,       0.55)),            // Med6 9     VeryFast Nosedown
MK36nBomb
                 ((0,          0,          0.07,       0.82,       0.11,       0,
0,          0,          0,          0),                // Med6 9     VeryFast to30
BRM
                  (0,          0,          0,          0.43,       0.55,
0.02,       0,          0,          0,          0),            // Med6 9
VeryFast to30       StoneFish
                  (0,          0,          0,          0.68,       0.31,
0.01,       0,          0,          0,          0),            // Med6 9
VeryFast to30       NRL MK56
                  (0,          0,          0,          0,          0,
0.01,       0.19,       0.43,       0.31,       0.06)),        // Med6 9
VeryFast to30       MK36nBomb
                 ((0,          0,          0.08,       0.79,       0.13,       0,
0,          0,          0,          0),                // Med6 9     VeryFast to45
BRM
                  (0,          0,          0,          0.57,       0.42,
0.01,       0,          0,          0,          0),            // Med6 9
VeryFast to45       StoneFish
                  (0,          0,          0,          0.68,       0.32,       0,
0,          0,          0,          0),                // Med6 9     VeryFast to45
NRL MK56
                  (0,          0,          0,          0,          0,
0.06,       0.43,       0.35,       0.16,       0)),           // Med6 9
VeryFast to45       MK36nBomb
                 ((0,          0,          0.01,       0.8,        0.19,       0,
0,          0,          0,          0),                // Med6 9     VeryFast to60
BRM
                  (0,          0,          0,          0.39,       0.59,
0.02,       0,          0,          0,          0),            // Med6 9
VeryFast to60       StoneFish
                  (0,          0,          0,          0.54,       0.46,       0,
0,          0,          0,          0),                // Med6 9     VeryFast to60
NRL MK56
                  (0,          0,          0,          0,          0,
0.27,       0.41,       0.22,       0.09,       0.01)),        // Med6 9
VeryFast to60       MK36nBomb
                 ((0,          0,          0,          0.52,       0.48,       0,
0,          0,          0,          0),                // Med6 9     VeryFast to75
BRM
                  (0,          0,          0,          0.06,       0.81,
0.13,       0,          0,          0,          0),            // Med6 9
VeryFast to75       StoneFish
                  (0,          0,          0,          0.22,       0.75,
0.03,       0,          0,          0,          0),            // Med6 9
VeryFast to75       NRL MK56
                  (0,          0,          0,          0,          0,
0.24,       0.47,       0.24,       0.05,       0)),           // Med6 9
VeryFast to75       MK36nBomb
                 ((0,          0,          0,          0.09,       0.85,
0.06,       0,          0,          0,          0),            // Med6 9
VeryFast Horizontal BRM
                  (0,          0,          0,          0,          0.64,
0.36,       0,          0,          0,          0),            // Med6 9
VeryFast Horizontal StoneFish
```

```
                   (0,           0,           0,           0,           0.66,
0.34,        0,           0,           0,           0),             // Med6 9
VeryFast Horizontal NRL MK56
                   (0,           0,           0,           0,           0.05,
0.14,        0.4,         0.34,        0.06,        0.01)))),       // Med6 9
VeryFast Horizontal MK36nBomb
                ((((0,           0.93,        0.07,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow Nosedown
BRM
                   (0,           0.6,         0.4,         0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow Nosedown
StoneFish
                   (0,           0.89,        0.11,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow Nosedown
NRL MK56
                   (0,           0,           0,           0.07,        0.59,
0.34,        0,           0,           0,           0)),            // MStiff9 12
VerySlow Nosedown   MK36nBomb
                  ((0,           0.87,        0.13,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to30
BRM
                   (0,           0.95,        0.05,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to30
StoneFish
                   (0,           0.83,        0.17,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to30
NRL MK56
                   (0,           0,           0,           0.21,        0.58,
0.21,        0,           0,           0,           0)),            // MStiff9 12
VerySlow to30       MK36nBomb
                  ((0,           0.67,        0.33,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to45
BRM
                   (0,           0.93,        0.07,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to45
StoneFish
                   (0,           0.6,         0.39,        0.01,        0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to45
NRL MK56
                   (0,           0,           0,           0.34,        0.57,
0.09,        0,           0,           0,           0)),            // MStiff9 12
VerySlow to45       MK36nBomb
                  ((0,           0.37,        0.63,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to60
BRM
                   (0,           0.75,        0.25,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to60
StoneFish
                   (0,           0.34,        0.65,        0.01,        0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to60
NRL MK56
                   (0,           0,           0,           0.55,        0.42,
0.03,        0,           0,           0,           0)),            // MStiff9 12
VerySlow to60       MK36nBomb
                  ((0,           0.27,        0.73,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to75
BRM
                   (0,           0.14,        0.81,        0.05,        0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to75
StoneFish
                   (0,           0.19,        0.81,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow to75
NRL MK56
                   (0,           0,           0,           0.78,        0.2,
0.02,        0,           0,           0,           0)),            // MStiff9 12
VerySlow to75       MK36nBomb
                  ((0,           0.19,        0.81,        0,           0,           0,
0,           0,           0,           0),              // MStiff9 12 VerySlow
Horizontal BRM
```

```
                   (0,          0.06,        0.91,        0.03,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 VerySlow
Horizontal StoneFish
                   (0,          0.1,         0.87,        0.03,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 VerySlow
Horizontal NRL MK56
                   (0.03,       0.3,         0.19,        0.4,         0.08,        0,
0,           0,           0,           0))),               // MStiff9 12 VerySlow
Horizontal MK36nBomb
                 (((0,          0.74,        0.26,        0,           0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     Nosedown
BRM
                   (0,          0.25,        0.75,        0,           0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     Nosedown
StoneFish
                   (0,          0.42,        0.58,        0,           0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     Nosedown
NRL MK56
                   (0,          0,           0,           0,           0.16,        0.6,
0.24,        0,           0,           0)),                // MStiff9 12 Slow     Nosedown
MK36nBomb
                  ((0,          0.61,        0.38,        0.01,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to30
BRM
                   (0,          0.42,        0.58,        0,           0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to30
StoneFish
                   (0,          0.33,        0.66,        0.01,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to30
NRL MK56
                   (0,          0,           0,           0.01,        0.47,
0.46,        0.06,        0,           0,           0)),             // MStiff9 12 Slow
to30       MK36nBomb
                  ((0,          0.4,         0.59,        0.01,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to45
BRM
                   (0,          0.44,        0.56,        0,           0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to45
StoneFish
                   (0,          0.25,        0.71,        0.04,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to45
NRL MK56
                   (0,          0,           0,           0.1,         0.62,
0.27,        0.01,        0,           0,           0)),             // MStiff9 12 Slow
to45       MK36nBomb
                  ((0,          0.15,        0.85,        0,           0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to60
BRM
                   (0,          0.17,        0.82,        0.01,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to60
StoneFish
                   (0,          0.06,        0.87,        0.07,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to60
NRL MK56
                   (0,          0,           0,           0.12,        0.73,
0.14,        0.01,        0,           0,           0)),             // MStiff9 12 Slow
to60       MK36nBomb
                  ((0,          0.02,        0.98,        0,           0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to75
BRM
                   (0,          0.01,        0.71,        0.28,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to75
StoneFish
                   (0,          0,           0.91,        0.09,        0,           0,
0,           0,           0,           0),                 // MStiff9 12 Slow     to75
NRL MK56
                   (0,          0,           0,           0.15,        0.78,
0.07,        0,           0,           0,           0)),             // MStiff9 12 Slow
to75       MK36nBomb
```

```
                  ((0,          0,          0.94,       0.06,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Slow
Horizontal BRM
                   (0,          0,          0.58,       0.42,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Slow
Horizontal StoneFish
                   (0,          0.01,       0.68,       0.31,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Slow
Horizontal NRL MK56
                   (0.01,       0.07,       0.3,        0.19,       0.41,
0.02,       0,          0,          0,          0))),            // MStiff9 12 Slow
Horizontal MK36nBomb
                 (((0,          0.19,       0.8,        0.01,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   Nosedown
BRM
                   (0,          0.01,       0.97,       0.02,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   Nosedown
StoneFish
                   (0,          0.02,       0.97,       0.01,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   Nosedown
NRL MK56
                   (0,          0,          0,          0,          0.03,
0.28,       0.59,       0.1,        0,          0)),             // MStiff9 12
Medium   Nosedown   MK36nBomb
                  ((0,          0.22,       0.78,       0,          0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to30
BRM
                   (0,          0,          1,          0,          0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to30
StoneFish
                   (0,          0,          0.97,       0.03,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to30
NRL MK56
                   (0,          0,          0,          0,          0.27,
0.45,       0.27,       0.01,       0,          0)),             // MStiff9 12
Medium   to30       MK36nBomb
                  ((0,          0.12,       0.85,       0.03,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to45
BRM
                   (0,          0.02,       0.98,       0,          0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to45
StoneFish
                   (0,          0.01,       0.86,       0.13,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to45
NRL MK56
                   (0,          0,          0,          0,          0.59,
0.35,       0.06,       0,          0,          0)),             // MStiff9 12
Medium   to45       MK36nBomb
                  ((0,          0.05,       0.89,       0.06,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to60
BRM
                   (0,          0,          0.96,       0.04,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to60
StoneFish
                   (0,          0,          0.81,       0.19,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to60
NRL MK56
                   (0,          0,          0,          0.01,       0.69,
0.25,       0.05,       0,          0,          0)),             // MStiff9 12
Medium   to60       MK36nBomb
                  ((0,          0,          0.91,       0.09,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to75
BRM
                   (0,          0,          0.27,       0.73,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to75
StoneFish
                   (0,          0,          0.44,       0.56,       0,          0,
0,          0,          0,          0),              // MStiff9 12 Medium   to75
NRL MK56
```

```
                    (0,          0,          0,          0,          0.73,
0.26,        0.01,       0,          0,          0)),            // MStiff9 12
Medium   to75       MK36nBomb
                   ((0,          0,          0.45,       0.55,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Medium
Horizontal BRM
                    (0,          0,          0.06,       0.94,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Medium
Horizontal StoneFish
                    (0,          0,          0.05,       0.95,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Medium
Horizontal NRL MK56
                    (0,          0.03,       0.22,       0.24,       0.38,
0.13,        0,          0,          0,          0))),           // MStiff9 12
Medium   Horizontal MK36nBomb
                  (((0,          0,          0.99,       0.01,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     Nosedown
BRM
                    (0,          0,          0.82,       0.18,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     Nosedown
StoneFish
                    (0,          0,          0.89,       0.11,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     Nosedown
NRL MK56
                    (0,          0,          0,          0,          0,
0.16,        0.48,       0.34,       0.02,       0)),            // MStiff9 12 Fast
Nosedown   MK36nBomb
                   ((0,          0,          0.95,       0.05,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to30
BRM
                    (0,          0,          0.84,       0.16,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to30
StoneFish
                    (0,          0,          0.83,       0.17,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to30
NRL MK56
                    (0,          0,          0,          0,          0.07,
0.44,        0.43,       0.06,       0,          0)),            // MStiff9 12 Fast
to30       MK36nBomb
                   ((0,          0.02,       0.85,       0.13,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to45
BRM
                    (0,          0,          0.91,       0.09,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to45
StoneFish
                    (0,          0,          0.71,       0.29,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to45
NRL MK56
                    (0,          0,          0,          0,          0.31,
0.49,        0.19,       0.01,       0,          0)),            // MStiff9 12 Fast
to45       MK36nBomb
                   ((0,          0,          0.7,        0.3,        0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to60
BRM
                    (0,          0,          0.72,       0.28,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to60
StoneFish
                    (0,          0,          0.43,       0.57,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to60
NRL MK56
                    (0,          0,          0,          0,          0.5,
0.35,        0.15,       0,          0,          0)),            // MStiff9 12 Fast
to60       MK36nBomb
                   ((0,          0,          0.48,       0.52,       0,          0,
0,           0,          0,          0),             // MStiff9 12 Fast     to75
BRM
                    (0,          0,          0.04,       0.95,       0.01,       0,
0,           0,          0,          0),             // MStiff9 12 Fast     to75
StoneFish
```

```
                   (0,          0,          0.12,       0.88,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 Fast     to75
NRL MK56
                   (0,          0,          0,          0,          0.42,
0.45,       0.13,       0,          0,          0)),            // MStiff9 12 Fast
to75       MK36nBomb
                  ((0,          0,          0.06,       0.94,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 Fast
Horizontal BRM
                   (0,          0,          0,          0.93,       0.07,       0,
0,          0,          0,          0),                 // MStiff9 12 Fast
Horizontal StoneFish
                   (0,          0,          0,          0.96,       0.04,       0,
0,          0,          0,          0),                 // MStiff9 12 Fast
Horizontal NRL MK56
                   (0,          0,          0.04,       0.27,       0.25,       0.4,
0.04,       0,          0,          0))),               // MStiff9 12 Fast
Horizontal MK36nBomb
                 (((0,          0,          0.63,       0.37,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast Nosedown
BRM
                   (0,          0,          0.13,       0.86,       0.01,       0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast Nosedown
StoneFish
                   (0,          0,          0.26,       0.74,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast Nosedown
NRL MK56
                   (0,          0,          0,          0,          0,
0.02,       0.18,       0.49,       0.28,       0.03)),         // MStiff9 12
VeryFast Nosedown   MK36nBomb
                  ((0,          0,          0.8,        0.2,        0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to30
BRM
                   (0,          0,          0.22,       0.78,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to30
StoneFish
                   (0,          0,          0.39,       0.61,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to30
NRL MK56
                   (0,          0,          0,          0,          0,
0.16,       0.5,        0.31,       0.03,       0)),            // MStiff9 12
VeryFast to30       MK36nBomb
                  ((0,          0,          0.57,       0.43,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to45
BRM
                   (0,          0,          0.39,       0.61,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to45
StoneFish
                   (0,          0,          0.34,       0.66,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to45
NRL MK56
                   (0,          0,          0,          0,          0.04,
0.47,       0.39,       0.1,        0,          0)),            // MStiff9 12
VeryFast to45       MK36nBomb
                  ((0,          0,          0.2,        0.8,        0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to60
BRM
                   (0,          0,          0.18,       0.8,        0.02,       0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to60
StoneFish
                   (0,          0,          0.11,       0.89,       0,          0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to60
NRL MK56
                   (0,          0,          0,          0,          0.11,
0.59,       0.23,       0.07,       0,          0)),            // MStiff9 12
VeryFast to60       MK36nBomb
                  ((0,          0,          0.01,       0.98,       0.01,       0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to75
BRM
```

```
                (0,         0,          0,          0.69,       0.31,       0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to75
StoneFish
                (0,         0,          0,          0.86,       0.14,       0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast to75
NRL MK56
                (0,         0,          0,          0,          0.05,
0.63,       0.3,        0.02,       0,          0)),                // MStiff9 12
VeryFast to75       MK36nBomb
               ((0,         0,          0,          0.79,       0.21,       0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast
Horizontal BRM
                (0,         0,          0,          0.3,        0.7,        0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast
Horizontal StoneFish
                (0,         0,          0,          0.32,       0.68,       0,
0,          0,          0,          0),                 // MStiff9 12 VeryFast
Horizontal NRL MK56
                (0,         0,          0,          0.05,       0.31,
0.34,       0.29,       0.01,       0,          0)))),              // MStiff9 12
VeryFast Horizontal MK36nBomb
             ((((0.06,      0.94,       0,          0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow Nosedown
BRM
                (0,         0.97,       0.03,       0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow Nosedown
StoneFish
                (0.04,      0.94,       0.02,       0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow Nosedown
NRL MK56
                (0,         0,          0,          0.5,        0.5,        0,
0,          0,          0,          0)),                // Stiff12 16 VerySlow Nosedown
MK36nBomb
               ((0.01,      0.96,       0.03,       0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to30
BRM
                (0,         1,          0,          0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to30
StoneFish
                (0,         0.97,       0.03,       0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to30
NRL MK56
                (0,         0,          0.06,       0.67,       0.27,       0,
0,          0,          0,          0)),                // Stiff12 16 VerySlow to30
MK36nBomb
               ((0.02,      0.9,        0.08,       0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to45
BRM
                (0,         1,          0,          0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to45
StoneFish
                (0,         0.88,       0.12,       0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to45
NRL MK56
                (0,         0,          0,          0.95,       0.05,       0,
0,          0,          0,          0)),                // Stiff12 16 VerySlow to45
MK36nBomb
               ((0.02,      0.76,       0.22,       0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to60
BRM
                (0,         0.99,       0.01,       0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to60
StoneFish
                (0,         0.7,        0.3,        0,          0,          0,
0,          0,          0,          0),                 // Stiff12 16 VerySlow to60
NRL MK56
                (0,         0,          0.06,       0.76,       0.18,       0,
0,          0,          0,          0)),                // Stiff12 16 VerySlow to60
MK36nBomb
```

```
                  ((0,           0.73,        0.27,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 VerySlow to75
BRM
                   (0,           0.49,        0.51,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 VerySlow to75
StoneFish
                   (0,           0.54,        0.46,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 VerySlow to75
NRL MK56
                   (0,           0,           0.04,        0.96,        0,           0,
0,           0,           0,           0)),               // Stiff12 16 VerySlow to75
MK36nBomb
                  ((0.02,        0.51,        0.47,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 VerySlow
Horizontal BRM
                   (0.01,        0.17,        0.82,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 VerySlow
Horizontal StoneFish
                   (0.02,        0.35,        0.61,        0.02,        0,           0,
0,           0,           0,           0),                // Stiff12 16 VerySlow
Horizontal NRL MK56
                   (0.18,        0.23,        0.19,        0.36,        0.04,        0,
0,           0,           0,           0))),              // Stiff12 16 VerySlow
Horizontal MK36nBomb
                 (((0,           0.98,        0.02,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     Nosedown
BRM
                   (0,           0.83,        0.17,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     Nosedown
StoneFish
                   (0,           0.94,        0.06,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     Nosedown
NRL MK56
                   (0,           0,           0,           0.13,        0.58,
0.29,        0,           0,           0,           0)),              // Stiff12 16 Slow
Nosedown   MK36nBomb
                  ((0,           0.91,        0.09,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to30
BRM
                   (0,           0.97,        0.03,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to30
StoneFish
                   (0,           0.84,        0.16,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to30
NRL MK56
                   (0,           0,           0,           0.14,        0.75,
0.11,        0,           0,           0,           0)),              // Stiff12 16 Slow
to30       MK36nBomb
                  ((0,           0.83,        0.17,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to45
BRM
                   (0,           0.97,        0.03,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to45
StoneFish
                   (0,           0.7,         0.3,         0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to45
NRL MK56
                   (0,           0,           0,           0.43,        0.55,
0.02,        0,           0,           0,           0)),              // Stiff12 16 Slow
to45       MK36nBomb
                  ((0,           0.51,        0.49,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to60
BRM
                   (0,           0.86,        0.14,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to60
StoneFish
                   (0,           0.33,        0.67,        0,           0,           0,
0,           0,           0,           0),                // Stiff12 16 Slow     to60
NRL MK56
```

```
                   (0,           0,           0.02,        0.65,        0.33,        0,
0,           0,           0,           0)),                 // Stiff12 16 Slow     to60
MK36nBomb
                  ((0,           0.12,        0.88,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Slow     to75
BRM
                   (0,           0.1,         0.88,        0.02,        0,           0,
0,           0,           0,           0),                  // Stiff12 16 Slow     to75
StoneFish
                   (0,           0.09,        0.91,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Slow     to75
NRL MK56
                   (0,           0,           0,           0.7,         0.3,         0,
0,           0,           0,           0)),                 // Stiff12 16 Slow     to75
MK36nBomb
                  ((0,           0.02,        0.98,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Slow
Horizontal BRM
                   (0,           0,           0.98,        0.02,        0,           0,
0,           0,           0,           0),                  // Stiff12 16 Slow
Horizontal StoneFish
                   (0,           0.03,        0.94,        0.03,        0,           0,
0,           0,           0,           0),                  // Stiff12 16 Slow
Horizontal NRL MK56
                   (0,           0.21,        0.29,        0.4,         0.1,         0,
0,           0,           0,           0))),                // Stiff12 16 Slow
Horizontal MK36nBomb
                 (((0,           0.91,        0.09,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   Nosedown
BRM
                   (0,           0.44,        0.56,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   Nosedown
StoneFish
                   (0,           0.67,        0.33,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   Nosedown
NRL MK56
                   (0,           0,           0,           0,           0.28,
0.69,        0.03,        0,           0,           0)),                 // Stiff12 16
Medium   Nosedown   MK36nBomb
                  ((0,           0.79,        0.21,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   to30
BRM
                   (0,           0.56,        0.44,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   to30
StoneFish
                   (0,           0.57,        0.43,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   to30
NRL MK56
                   (0,           0,           0,           0.07,        0.7,
0.23,        0,           0,           0,           0)),                 // Stiff12 16
Medium   to30       MK36nBomb
                  ((0,           0.68,        0.32,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   to45
BRM
                   (0,           0.65,        0.35,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   to45
StoneFish
                   (0,           0.38,        0.6,         0.02,        0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   to45
NRL MK56
                   (0,           0,           0,           0.11,        0.56,
0.33,        0,           0,           0,           0)),                 // Stiff12 16
Medium   to45       MK36nBomb
                  ((0,           0.26,        0.74,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   to60
BRM
                   (0,           0.42,        0.58,        0,           0,           0,
0,           0,           0,           0),                  // Stiff12 16 Medium   to60
StoneFish
```

```
                   (0,          0.22,        0.78,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Medium   to60
NRL MK56
                   (0,          0,           0,           0.28,        0.62,        0.1,
0,           0,           0,           0)),                // Stiff12 16 Medium   to60
MK36nBomb
                  ((0,          0.01,        0.99,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Medium   to75
BRM
                   (0,          0.01,        0.84,        0.15,        0,           0,
0,           0,           0,           0),                 // Stiff12 16 Medium   to75
StoneFish
                   (0,          0.01,        0.99,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Medium   to75
NRL MK56
                   (0,          0,           0,           0.18,        0.75,
0.07,        0,           0,           0,           0)),            // Stiff12 16
Medium   to75       MK36nBomb
                  ((0,          0,           0.97,        0.03,        0,           0,
0,           0,           0,           0),                 // Stiff12 16 Medium
Horizontal BRM
                   (0,          0,           0.65,        0.35,        0,           0,
0,           0,           0,           0),                 // Stiff12 16 Medium
Horizontal StoneFish
                   (0,          0.01,        0.67,        0.32,        0,           0,
0,           0,           0,           0),                 // Stiff12 16 Medium
Horizontal NRL MK56
                   (0.02,       0.06,        0,           0.32,        0.16,        0.42,
0.02,        0,           0,           0,           0))),           // Stiff12 16
Medium   Horizontal MK36nBomb
                 (((0,          0.36,        0.64,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     Nosedown
BRM
                   (0,          0.03,        0.97,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     Nosedown
StoneFish
                   (0,          0.11,        0.89,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     Nosedown
NRL MK56
                   (0,          0,           0,           0,           0.1,         0.5,
0.39,        0.01,        0,           0)),                // Stiff12 16 Fast     Nosedown
MK36nBomb
                  ((0,          0.47,        0.53,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     to30
BRM
                   (0,          0.04,        0.96,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     to30
StoneFish
                   (0,          0.08,        0.92,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     to30
NRL MK56
                   (0,          0,           0,           0,           0.42,
0.51,        0.07,        0,           0,           0)),            // Stiff12 16 Fast
to30       MK36nBomb
                  ((0,          0.36,        0.64,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     to45
BRM
                   (0,          0.16,        0.84,        0,           0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     to45
StoneFish
                   (0,          0.11,        0.87,        0.02,        0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     to45
NRL MK56
                   (0,          0,           0,           0.05,        0.76,
0.19,        0,           0,           0,           0)),            // Stiff12 16 Fast
to45       MK36nBomb
                  ((0,          0.08,        0.9,         0.02,        0,           0,
0,           0,           0,           0),                 // Stiff12 16 Fast     to60
BRM
```

```
                    (0,           0.03,        0.96,        0.01,        0,           0,
0,            0,            0,            0),              // Stiff12 16 Fast     to60
StoneFish
                    (0,           0.02,        0.88,        0.1,         0,           0,
0,            0,            0,            0),              // Stiff12 16 Fast     to60
NRL MK56
                    (0,           0,           0,           0.07,        0.66,
0.27,         0,            0,            0,            0)),             // Stiff12 16 Fast
to60       MK36nBomb
                   ((0,           0.01,        0.97,        0.02,        0,           0,
0,            0,            0,            0),              // Stiff12 16 Fast     to75
BRM
                    (0,           0,           0.55,        0.45,        0,           0,
0,            0,            0,            0),              // Stiff12 16 Fast     to75
StoneFish
                    (0,           0,           0.7,         0.3,         0,           0,
0,            0,            0,            0),              // Stiff12 16 Fast     to75
NRL MK56
                    (0,           0,           0,           0.03,        0.77,        0.2,
0,            0,            0,            0)),             // Stiff12 16 Fast     to75
MK36nBomb
                   ((0,           0,           0.53,        0.47,        0,           0,
0,            0,            0,            0),              // Stiff12 16 Fast
Horizontal BRM
                    (0,           0,           0.09,        0.91,        0,           0,
0,            0,            0,            0),              // Stiff12 16 Fast
Horizontal StoneFish
                    (0,           0,           0.07,        0.93,        0,           0,
0,            0,            0,            0),              // Stiff12 16 Fast
Horizontal NRL MK56
                    (0,           0,           0.26,        0.16,        0.43,
0.15,         0,            0,            0,            0))),            // Stiff12 16 Fast
Horizontal MK36nBomb
                  (((0,           0,           1,           0,           0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast Nosedown
BRM
                    (0,           0,           0.85,        0.15,        0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast Nosedown
StoneFish
                    (0,           0,           0.91,        0.09,        0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast Nosedown
NRL MK56
                    (0,           0,           0,           0,           0.03,
0.16,         0.53,         0.27,         0.01,         0)),             // Stiff12 16
VeryFast Nosedown   MK36nBomb
                   ((0,           0.01,        0.97,        0.02,        0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast to30
BRM
                    (0,           0,           0.92,        0.08,        0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast to30
StoneFish
                    (0,           0,           0.97,        0.03,        0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast to30
NRL MK56
                    (0,           0,           0,           0,           0.15,
0.57,         0.26,         0.02,         0,            0)),             // Stiff12 16
VeryFast to30       MK36nBomb
                   ((0,           0.04,        0.92,        0.04,        0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast to45
BRM
                    (0,           0,           0.98,        0.02,        0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast to45
StoneFish
                    (0,           0,           0.9,         0.1,         0,           0,
0,            0,            0,            0),              // Stiff12 16 VeryFast to45
NRL MK56
                    (0,           0,           0,           0,           0.42,
0.42,         0.16,         0,            0,            0)),             // Stiff12 16
VeryFast to45       MK36nBomb
```

```
                  ((0,           0.01,        0.84,        0.15,        0,           0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast to60
BRM
                   (0,           0,           0.81,        0.19,        0,           0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast to60
StoneFish
                   (0,           0,           0.64,        0.36,        0,           0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast to60
NRL MK56
                   (0,           0,           0,           0,           0.64,        0.3,
0.06,         0,            0,            0)),                // Stiff12 16 VeryFast to60
MK36nBomb
                  ((0,           0,           0.48,        0.52,        0,           0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast to75
BRM
                   (0,           0,           0.1,         0.9,         0,           0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast to75
StoneFish
                   (0,           0,           0.16,        0.84,        0,           0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast to75
NRL MK56
                   (0,           0,           0,           0,           0.46,
0.51,         0.03,         0,            0,           0)),             // Stiff12 16
VeryFast to75       MK36nBomb
                  ((0,           0,           0.04,        0.96,        0,           0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast
Horizontal BRM
                   (0,           0,           0,           0.95,        0.05,        0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast
Horizontal StoneFish
                   (0,           0,           0,           0.93,        0.07,        0,
0,            0,            0,            0),                 // Stiff12 16 VeryFast
Horizontal NRL MK56
                   (0,           0,           0.03,        0.23,        0.25,
0.47,         0.02,         0,            0,           0)))),           // Stiff12 16
VeryFast Horizontal MK36nBomb
                ((((0.44,        0.56,        0,           0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow Nosedown
BRM
                   (0.18,        0.82,        0,           0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow Nosedown
StoneFish
                   (0.45,        0.55,        0,           0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow Nosedown
NRL MK56
                   (0,           0,           0.64,        0.36,        0,           0,
0,            0,            0,            0)),                // Hard16 30  VerySlow Nosedown
MK36nBomb
                  ((0.45,        0.55,        0,           0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow to30
BRM
                   (0.37,        0.63,        0,           0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow to30
StoneFish
                   (0.33,        0.66,        0.01,        0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow to30
NRL MK56
                   (0,           0,           0.56,        0.44,        0,           0,
0,            0,            0,            0)),                // Hard16 30  VerySlow to30
MK36nBomb
                  ((0.59,        0.41,        0,           0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow to45
BRM
                   (0.27,        0.73,        0,           0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow to45
StoneFish
                   (0.37,        0.61,        0.02,        0,           0,           0,
0,            0,            0,            0),                 // Hard16 30  VerySlow to45
NRL MK56
```

```
                   (0,          0,           0.65,        0.35,        0,           0,
0,           0,           0,           0)),               // Hard16 30  VerySlow to45
MK36nBomb
                  ((0.4,        0.58,        0.02,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow to60
BRM
                   (0.45,       0.55,        0,           0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow to60
StoneFish
                   (0.24,       0.72,        0.04,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow to60
NRL MK56
                   (0,          0.01,        0.72,        0.27,        0,           0,
0,           0,           0,           0)),               // Hard16 30  VerySlow to60
MK36nBomb
                  ((0.09,       0.89,        0.02,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow to75
BRM
                   (0.2,        0.64,        0.16,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow to75
StoneFish
                   (0.06,       0.88,        0.06,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow to75
NRL MK56
                   (0,          0,           0.82,        0.18,        0,           0,
0,           0,           0,           0)),               // Hard16 30  VerySlow to75
MK36nBomb
                  ((0.09,       0.79,        0.12,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow
Horizontal BRM
                   (0.01,       0.57,        0.42,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow
Horizontal StoneFish
                   (0.06,       0.74,        0.2,         0,           0,           0,
0,           0,           0,           0),                // Hard16 30  VerySlow
Horizontal NRL MK56
                   (0.2,        0.26,        0.42,        0.12,        0,           0,
0,           0,           0,           0))),              // Hard16 30  VerySlow
Horizontal MK36nBomb
                 (((0.05,       0.95,        0,           0,           0,           0,
0,           0,           0,           0),                // Hard16 30  Slow     Nosedown
BRM
                   (0,          1,           0,           0,           0,           0,
0,           0,           0,           0),                // Hard16 30  Slow     Nosedown
StoneFish
                   (0.08,       0.92,        0,           0,           0,           0,
0,           0,           0,           0),                // Hard16 30  Slow     Nosedown
NRL MK56
                   (0,          0,           0.18,        0.65,        0.17,        0,
0,           0,           0,           0)),               // Hard16 30  Slow     Nosedown
MK36nBomb
                  ((0.06,       0.94,        0,           0,           0,           0,
0,           0,           0,           0),                // Hard16 30  Slow     to30
BRM
                   (0,          1,           0,           0,           0,           0,
0,           0,           0,           0),                // Hard16 30  Slow     to30
StoneFish
                   (0.02,       0.97,        0.01,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  Slow     to30
NRL MK56
                   (0,          0,           0.32,        0.6,         0.08,        0,
0,           0,           0,           0)),               // Hard16 30  Slow     to30
MK36nBomb
                  ((0.18,       0.81,        0.01,        0,           0,           0,
0,           0,           0,           0),                // Hard16 30  Slow     to45
BRM
                   (0,          1,           0,           0,           0,           0,
0,           0,           0,           0),                // Hard16 30  Slow     to45
StoneFish
```

```
            (0.05,     0.93,     0.02,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow    to45
NRL MK56
            (0,        0,        0.27,     0.69,     0.04,     0,
0,        0,        0,        0)),             // Hard16 30  Slow    to45
MK36nBomb
           ((0.12,     0.79,     0.09,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow    to60
BRM
            (0,        1,        0,        0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow    to60
StoneFish
            (0.04,     0.85,     0.11,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow    to60
NRL MK56
            (0,        0,        0.36,     0.62,     0.02,     0,
0,        0,        0,        0)),             // Hard16 30  Slow    to60
MK36nBomb
           ((0.02,     0.84,     0.14,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow    to75
BRM
            (0,        0.72,     0.28,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow    to75
StoneFish
            (0,        0.67,     0.33,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow    to75
NRL MK56
            (0,        0,        0.33,     0.64,     0.03,     0,
0,        0,        0,        0)),             // Hard16 30  Slow    to75
MK36nBomb
           ((0.01,     0.55,     0.44,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow
Horizontal BRM
            (0,        0.25,     0.75,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow
Horizontal StoneFish
            (0.01,     0.4,      0.59,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Slow
Horizontal NRL MK56
            (0.07,     0.33,     0.23,     0.37,     0,        0,
0,        0,        0,        0))),            // Hard16 30  Slow
Horizontal MK36nBomb
          (((0,        1,        0,        0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Medium  Nosedown
BRM
            (0,        0.98,     0.02,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Medium  Nosedown
StoneFish
            (0,        1,        0,        0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Medium  Nosedown
NRL MK56
            (0,        0,        0.01,     0.51,     0.46,
0.02,     0,        0,        0,        0)),             // Hard16 30
Medium   Nosedown   MK36nBomb
           ((0,        0.99,     0.01,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Medium  to30
BRM
            (0,        1,        0,        0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Medium  to30
StoneFish
            (0,        0.99,     0.01,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Medium  to30
NRL MK56
            (0,        0,        0.06,     0.71,     0.23,     0,
0,        0,        0,        0)),             // Hard16 30  Medium  to30
MK36nBomb
           ((0.02,     0.96,     0.02,     0,        0,        0,
0,        0,        0,        0),              // Hard16 30  Medium  to45
BRM
```

```
                   (0,           1,            0,            0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium   to45
StoneFish
                   (0,           0.93,         0.07,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium   to45
NRL MK56
                   (0,           0,            0.1,          0.72,         0.18,         0,
0,            0,            0,            0)),               // Hard16 30  Medium   to45
MK36nBomb
                  ((0.02,        0.79,         0.19,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium   to60
BRM
                   (0,           1,            0,            0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium   to60
StoneFish
                   (0.01,        0.74,         0.25,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium   to60
NRL MK56
                   (0,           0,            0.11,         0.82,         0.07,         0,
0,            0,            0,            0)),               // Hard16 30  Medium   to60
MK36nBomb
                  ((0,           0.54,         0.46,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium   to75
BRM
                   (0,           0.48,         0.52,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium   to75
StoneFish
                   (0,           0.4,          0.6,          0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium   to75
NRL MK56
                   (0,           0,            0.07,         0.85,         0.08,         0,
0,            0,            0,            0)),               // Hard16 30  Medium   to75
MK36nBomb
                  ((0,           0.19,         0.81,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Medium
Horizontal BRM
                   (0,           0,            0.97,         0.03,         0,            0,
0,            0,            0,            0),                // Hard16 30  Medium
Horizontal StoneFish
                   (0,           0.07,         0.92,         0.01,         0,            0,
0,            0,            0,            0),                // Hard16 30  Medium
Horizontal NRL MK56
                   (0.03,        0.26,         0.21,         0.45,         0.05,         0,
0,            0,            0,            0))),              // Hard16 30  Medium
Horizontal MK36nBomb
                 (((0,           0.99,         0.01,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Fast     Nosedown
BRM
                   (0,           0.89,         0.11,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Fast     Nosedown
StoneFish
                   (0,           0.93,         0.07,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Fast     Nosedown
NRL MK56
                   (0,           0,            0,            0.26,         0.54,         0.2,
0,            0,            0,            0)),               // Hard16 30  Fast     Nosedown
MK36nBomb
                  ((0,           0.98,         0.02,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Fast     to30
BRM
                   (0,           0.95,         0.05,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Fast     to30
StoneFish
                   (0,           0.94,         0.06,         0,            0,            0,
0,            0,            0,            0),                // Hard16 30  Fast     to30
NRL MK56
                   (0,           0,            0,            0.56,         0.39,
0.05,         0,            0,            0,            0)),              // Hard16 30  Fast
to30       MK36nBomb
```

```
              ((0,         0.93,       0.07,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to45
BRM
               (0,         1,          0,          0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to45
StoneFish
               (0,         0.86,       0.14,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to45
NRL MK56
               (0,         0,          0.03,       0.66,       0.29,
0.02,       0,          0,          0,          0)),                // Hard16 30  Fast
to45       MK36nBomb
              ((0,         0.66,       0.34,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to60
BRM
               (0,         0.71,       0.29,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to60
StoneFish
               (0,         0.55,       0.45,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to60
NRL MK56
               (0,         0,          0.02,       0.69,       0.28,
0.01,       0,          0,          0,          0)),                // Hard16 30  Fast
to60       MK36nBomb
              ((0,         0.23,       0.77,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to75
BRM
               (0,         0.16,       0.84,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to75
StoneFish
               (0,         0.14,       0.86,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast     to75
NRL MK56
               (0,         0,          0,          0.73,       0.27,       0,
0,          0,          0,          0)),                // Hard16 30  Fast     to75
MK36nBomb
              ((0,         0.02,       0.97,       0.01,       0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast
Horizontal BRM
               (0,         0,          0.92,       0.08,       0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast
Horizontal StoneFish
               (0,         0,          0.9,        0.1,        0,          0,
0,          0,          0,          0),                 // Hard16 30  Fast
Horizontal NRL MK56
               (0.01,      0.16,       0.27,       0.34,       0.22,       0,
0,          0,          0,          0))),               // Hard16 30  Fast
Horizontal MK36nBomb
             (((0,         0.74,       0.26,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  VeryFast Nosedown
BRM
               (0,         0.62,       0.38,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  VeryFast Nosedown
StoneFish
               (0,         0.59,       0.41,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  VeryFast Nosedown
NRL MK56
               (0,         0,          0,          0.03,       0.45,
0.44,       0.08,       0,          0,          0)),                // Hard16 30
VeryFast Nosedown   MK36nBomb
              ((0,         0.82,       0.18,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  VeryFast to30
BRM
               (0,         0.53,       0.47,       0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  VeryFast to30
StoneFish
               (0,         0.7,        0.3,        0,          0,          0,
0,          0,          0,          0),                 // Hard16 30  VeryFast to30
NRL MK56
```

```
                   (0,          0,          0,          0.17,       0.63,
0.19,       0.01,       0,          0,          0)),           // Hard16 30
VeryFast to30      MK36nBomb
                  ((0,          0.78,       0.22,       0,          0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to45
BRM
                   (0,          0.63,       0.37,       0,          0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to45
StoneFish
                   (0,          0.61,       0.39,       0,          0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to45
NRL MK56
                   (0,          0,          0,          0.36,       0.56,
0.08,       0,          0,          0,          0)),           // Hard16 30
VeryFast to45      MK36nBomb
                  ((0,          0.42,       0.58,       0,          0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to60
BRM
                   (0,          0.54,       0.46,       0,          0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to60
StoneFish
                   (0,          0.3,        0.69,       0.01,       0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to60
NRL MK56
                   (0,          0,          0,          0.51,       0.47,
0.02,       0,          0,          0,          0)),           // Hard16 30
VeryFast to60      MK36nBomb
                  ((0,          0.04,       0.95,       0.01,       0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to75
BRM
                   (0,          0.08,       0.86,       0.06,       0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to75
StoneFish
                   (0,          0.03,       0.88,       0.09,       0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast to75
NRL MK56
                   (0,          0,          0,          0.39,       0.57,
0.04,       0,          0,          0,          0)),           // Hard16 30
VeryFast to75      MK36nBomb
                  ((0,          0,          0.79,       0.21,       0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast
Horizontal BRM
                   (0,          0.01,       0.51,       0.48,       0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast
Horizontal StoneFish
                   (0,          0,          0.54,       0.46,       0,          0,
0,          0,          0,          0),              // Hard16 30  VeryFast
Horizontal NRL MK56
                   (0,          0.03,       0.29,       0.24,       0.4,
0.04,       0,          0,          0,          0)))),         // Hard16 30
VeryFast Horizontal MK36nBomb
                ((((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),              // Rock       VerySlow Nosedown
BRM
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),              // Rock       VerySlow Nosedown
StoneFish
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),              // Rock       VerySlow Nosedown
NRL MK56
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),             // Rock       VerySlow Nosedown
MK36nBomb
                  ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),              // Rock       VerySlow to30
BRM
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),              // Rock       VerySlow to30
StoneFish
```

```
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to30
NRL MK56
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0)),             // Rock       VerySlow to30
MK36nBomb
                   ((1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to45
BRM
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to45
StoneFish
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to45
NRL MK56
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0)),             // Rock       VerySlow to45
MK36nBomb
                   ((1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to60
BRM
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to60
StoneFish
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to60
NRL MK56
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0)),             // Rock       VerySlow to60
MK36nBomb
                   ((1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to75
BRM
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to75
StoneFish
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow to75
NRL MK56
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0)),             // Rock       VerySlow to75
MK36nBomb
                   ((1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow
Horizontal BRM
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow
Horizontal StoneFish
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       VerySlow
Horizontal NRL MK56
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0))),            // Rock       VerySlow
Horizontal MK36nBomb
                  (((1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       Slow     Nosedown
BRM
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       Slow     Nosedown
StoneFish
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       Slow     Nosedown
NRL MK56
                    (1,           0,            0,            0,            0,            0,
0,            0,            0,            0)),             // Rock       Slow     Nosedown
MK36nBomb
                   ((1,           0,            0,            0,            0,            0,
0,            0,            0,            0),              // Rock       Slow     to30
BRM
```

```
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to30
StoneFish
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to30
NRL MK56
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),              // Rock       Slow     to30
MK36nBomb
                  ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to45
BRM
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to45
StoneFish
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to45
NRL MK56
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),              // Rock       Slow     to45
MK36nBomb
                  ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to60
BRM
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to60
StoneFish
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to60
NRL MK56
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),              // Rock       Slow     to60
MK36nBomb
                  ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to75
BRM
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to75
StoneFish
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow     to75
NRL MK56
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),              // Rock       Slow     to75
MK36nBomb
                  ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow
Horizontal BRM
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow
Horizontal StoneFish
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Slow
Horizontal NRL MK56
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0))),             // Rock       Slow
Horizontal MK36nBomb
                 (((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Medium   Nosedown
BRM
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Medium   Nosedown
StoneFish
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),               // Rock       Medium   Nosedown
NRL MK56
                   (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),              // Rock       Medium   Nosedown
MK36nBomb
```

```
                  ((1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to30
BRM
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to30
StoneFish
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to30
NRL MK56
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0)),                // Rock      Medium   to30
MK36nBomb
                  ((1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to45
BRM
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to45
StoneFish
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to45
NRL MK56
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0)),                // Rock      Medium   to45
MK36nBomb
                  ((1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to60
BRM
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to60
StoneFish
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to60
NRL MK56
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0)),                // Rock      Medium   to60
MK36nBomb
                  ((1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to75
BRM
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to75
StoneFish
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium   to75
NRL MK56
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0)),                // Rock      Medium   to75
MK36nBomb
                  ((1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium
Horizontal BRM
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium
Horizontal StoneFish
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Medium
Horizontal NRL MK56
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0))),               // Rock      Medium
Horizontal MK36nBomb
                 (((1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Fast     Nosedown
BRM
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Fast     Nosedown
StoneFish
                   (1,          0,           0,           0,           0,           0,
0,           0,           0,           0),                 // Rock      Fast     Nosedown
NRL MK56
```

```
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),          // Rock      Fast     Nosedown
MK36nBomb
                 ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to30
BRM
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to30
StoneFish
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to30
NRL MK56
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),          // Rock      Fast     to30
MK36nBomb
                 ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to45
BRM
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to45
StoneFish
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to45
NRL MK56
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),          // Rock      Fast     to45
MK36nBomb
                 ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to60
BRM
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to60
StoneFish
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to60
NRL MK56
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),          // Rock      Fast     to60
MK36nBomb
                 ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to75
BRM
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to75
StoneFish
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast     to75
NRL MK56
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0)),          // Rock      Fast     to75
MK36nBomb
                 ((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast
Horizontal BRM
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast
Horizontal StoneFish
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      Fast
Horizontal NRL MK56
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0))),         // Rock      Fast
Horizontal MK36nBomb
                (((1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      VeryFast Nosedown
BRM
                  (1,          0,          0,          0,          0,          0,
0,          0,          0,          0),           // Rock      VeryFast Nosedown
StoneFish
```

```
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast Nosedown
NRL MK56
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0)),              // Rock       VeryFast Nosedown
MK36nBomb
                  ((1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to30
BRM
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to30
StoneFish
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to30
NRL MK56
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0)),              // Rock       VeryFast to30
MK36nBomb
                  ((1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to45
BRM
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to45
StoneFish
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to45
NRL MK56
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0)),              // Rock       VeryFast to45
MK36nBomb
                  ((1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to60
BRM
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to60
StoneFish
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to60
NRL MK56
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0)),              // Rock       VeryFast to60
MK36nBomb
                  ((1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to75
BRM
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to75
StoneFish
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast to75
NRL MK56
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0)),              // Rock       VeryFast to75
MK36nBomb
                  ((1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast
Horizontal BRM
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast
Horizontal StoneFish
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0),               // Rock       VeryFast
Horizontal NRL MK56
                   (1,           0,           0,           0,           0,           0,
0,           0,           0,           0)))));           // Rock       VeryFast
Horizontal MK36nBomb ;
       title = “Area End State”;
       comment = “\n”;
       whenchanged = 1214851329;
```

```
        belief = (0.1268772, 0.1023547, 0.1890801, 0.1366767, 0.1087449, 0.08105914,
0.06719414, 0.05432787, 0.03981904, 0.09386618);
        visual V1 {
                center = (588, 222);
                dispform = BELIEFBARS;
                height = 3;
                link 3 {
                        path = ((416, 163), (503, 193));
                        };
                };
        };
ElimOrder = (TI, WD, MT, WT, WVZ, SS, AreaEndState);
};
```

```
% This code combines the results from 16 common Netica configurations
of the MBES

clc; clear all; close all;

uniform = [12.7 10.2 18.9 13.7 10.9 8.11 6.72 5.43 3.98 9.39];
shal = [12.8 10.6 19.5 14.4 11.2 7.93 6.34 4.90 3.53 8.86];
int = [12.7 10.4 18.8 13.6 10.8 8.10 6.78 5.42 4.00 9.43];
deep = [12.6 9.73 18.4 13 10.6 8.29 7.03 5.98 4.42 9.87];
sand = [23.6 20.7 20.7 12.7 8.82 5.07 3.29 2.11 1.15 1.95];
silt = [4.98 10.4 19.1 17.8 13.4 9.56 7.51 5.41 3.51 8.36];
clay = [0.035 0.32 2.15 5.54 8.46 11.1 13 14 12.9 32.6];
shal_sand = [23.7 20.7 21.5 13.3 8.63 4.74 2.91 1.79 0.98 1.64];
int_sand = [23.5 21 20.4 12.7 8.87 5.06 3.33 .10 1.13 1.88];
deep_sand = [23.5 20.3 20.2 12 8.97 5.41 3.61 2.44 1.34 2.33];
shal_silt = [5.05 10.6 20.1 18.7 13.7 9.4 6.95 4.87 3.17 7.53];
int_silt = [4.95 10.5 19 17.8 13.2 9.54 7.68 5.48 3.53 8.29];
deep_silt = [4.92 9.95 18.3 17.1 13.2 9.74 7.89 5.89 3.82 9.26];
shal_clay = [0.037 0.35 2.38 6.13 9.6 11.4 13.2 13 11.4 32.4];
int_clay = [0.034 0.32 2.15 5.51 8.2 11 12.8 13.8 13.0 33.2];
deep_clay = [0.033 0.29 1.9 4.99 7.58 10.9 12.9 15.2 14.3 32];
all = [uniform;shal;int;deep;sand;silt;clay;shal_sand;int_sand;

deep_sand;shal_silt;int_silt;deep_silt;shal_clay;int_clay;deep_clay];

figure
bar(all', '');
grid on;
axis([.5 10.5 0 100]);
set(gca,'xtick', 1:10)
set(gca,'xticklabel',str2mat('0-10','10-20','20-30','30-40','40-50',...
    '50-60','60-70','70-80','89-90','90-100'))
ylabel('Probability');
xlabel('Percent Burial')
title('Results of 16 common runs of MBES using Netica');
legend('uniform','shallow','intermediate','deep','sand','silt','clay',.
..
    'shal sand','inter sand','deep sand','shal silt','inter silt',...
    'deep silt','shal clay','inter clay','deep clay')

% This code compares the results of sand for all four mine types

clc; clear all; close all;

brmsand = [24.5 32.9 28.6 9.77 2.73 1 .32 .14 .051 .025];
stonesand = [23.3 29.8 24.5 11.7 5.16 2.52 1.4 .91 .28 .36];
nrlsand = [23.2 19.2 28.4 16.5 7.14 2.98 1.68 .58 .25 .084];
mk36sand = [23.3 .71 1.27 12.8 20.3 13.8 9.74 6.83 4.02 7.33];
all = [brmsand; stonesand; nrlsand; mk36sand];

figure
bar(all', '');
grid on;
axis([.5 10.5 0 100]);
```

```
set(gca,'xtick', 1:10)
set(gca,'xticklabel',str2mat('0-10','10-20','20-30','30-40','40-50',...
    '50-60','60-70','70-80','89-90','90-100'))
ylabel('Probability');
xlabel('Percent Burial')
title('Comparison of All Four Mine Types of the MBES in Sand');
legend('BRM','Stonefish','NRL MK56','MK36')

% This code compares the results of silt for all four mine types

clc; clear all; close all;

brmsilt = [5.41 17.7 32.4 22.9 11.1 5.54 2.7 1.43 .56 .27];
stonesilt = [4.87 14.5 22.7 18.9 12.8 8.94 6.44 4.6 2.37 3.89];
nrlsilt = [4.79 8.88 20.4 23.1 16.4 10.7 8.11 4.08 2.52 .92];
mk36silt = [4.83 .42 .89 6.37 13.2 13 12.8 11.5 8.57 28.4];
all = [brmsilt; stonesilt; nrlsilt; mk36silt];

figure
bar(all', '');
grid on;
axis([.5 10.5 0 100]);
set(gca,'xtick', 1:10)
set(gca,'xticklabel',str2mat('0-10','10-20','20-30','30-40','40-50',...
    '50-60','60-70','70-80','89-90','90-100'))
ylabel('Probability');
xlabel('Percent Burial')
title('Comparison of All Four Mine Types of the MBES in Silt');
legend('BRM','Stonefish','NRL MK56','MK36')

% This code compares the results of clay for all four mine types

clc; clear all; close all;

brmclay = [.045 .66 5.14 13 18.5 21 20.9 13.1 5.22 2.51];
stoneclay = [.032 .4 2.09 4.51 6.57 9.73 9.92 12.6 18 36.1];
nrlclay = [.03 .21 1.27 4.38 7.89 11.8 17.9 25.5 22.6 8.56];
mk36clay = [.032 .022 .079 .25 .93 1.88 3.21 4.79 5.72 83.1];
all = [brmclay; stoneclay; nrlclay; mk36clay];

figure
bar(all', '');
grid on;
axis([.5 10.5 0 100]);
set(gca,'xtick', 1:10)
set(gca,'xticklabel',str2mat('0-10','10-20','20-30','30-40','40-50',...
    '50-60','60-70','70-80','89-90','90-100'))
ylabel('Probability');
xlabel('Percent Burial')
title('Comparison of All Four Mine Types of the MBES in Clay');
legend('BRM','Stonefish','NRL MK56','MK36')
```

LIST OF REFERENCES

[1] Taber, V.L. (1999). "Environmental Sensitivity Study on Mine Impact Burial Prediction Model." *Master Thesis*, Naval Postgraduate School, Monterey, CA.

[2] R. A. Arnone and L. E. Bowen. (1980). "Prediction of the time history penetration of a cylinder through the air-water-sediment phases," Naval Coast. Syst. Ctr., Panama City, FL, TN 734–736.

[3] PEO LMW. (2009). *21st Century U.S. Navy Mine Warfare* [ebook]. Available: https://acquisition.navy.mil/rda/content/download/6146/28176/version/1/file/MIW+21st+Century+eBook+-+062009.pdf

[4] Schroeder, D. (2003). *The History of the Sea Mine and its Continued Importance in Today's Navy.* [ebook] Available: http://www.history.navy.mil/museums/keyport/The_History_of_the_Sea_Mine.pdf

[5] R. H.Wilkens and M. D. Richardson. (2007) "Mine burial prediction: A short history and introduction," *IEEE. J. Ocean. Eng.*, vol. 32, no. 1, pp. 3–9.

[6] G.K. Hartmann and S.C. Truver. (1991). Weapons that Wait. (Annapolis, Naval Institute Press), 50.

[7] S.C. Truver. (2008). Mines and Underwater IEDs in U.S. Ports and Waterways, Context, Threats, Challenges, and Solutions. *Naval War College Review, Vol. 61, No. 1*.

[8] P.C. Chu. (2009). Mine Impact Burial Prediction From One to Three Dimensions. *Applied Mechanics Reviews Vol. 62.*

[9] P.C. Chu, T.B. Smith, and S.D. Haegar. (2000). Mine Impact Burial Prediction Experiment. *Journal of Counter-Ordnance Technology (Fifth International Symposium on Technology and Mine Problem).*

[10] P. C. Chu, A. Evans, T. Gilles, T. Smith, and V. Taber. (2004). "Development of Navy's 3Dmine impact burial prediction model (IMPACT35)," in *Proc. 6th Int. Symp. Technol. Mine Problem*, Monterey, CA.

[11] P.C. Chu and Chenwu Fan. (2007). Mine-Impact Burial Model (IMPACT35) Verification and Improvement Using Sediment Bearing Factor Method. *IEEE Journal of Oceanic Engineering, Vol. 32, No. 1.*

[12] G. R. Bower, M. D. Richardson, K. B. Briggs, P. A. Elmore, E. F. Braithwaite, J. Bradley, S. Griffin, T. F. Wever, and R. Lühder. (2007). "Measured and predicted burial of cylinders during the Indian Rocks Beach experiment," *IEEE Journal of Oceanic. Engineering, Vol. 32, No. 1,* pp. 91–102.

[13] Merriam-Webster Online Dictionary. Available: http://www. merriam-webster.com/dictionary/scour

[14] R. Whitehouse. (1998). *Scour at Marine Structures, A Manual for Practical Applications*. London, U.K.: Thomas Telford.

[15] Rennie, S.E., Brandt, A., Plant, N. (2005). *Mine Burial Expert System*, JHU-APL NSTD-05–021.

[16] Norsys Software Corporation. (2004). http://www.norsys.com

[17] Rennie, S.E., Brandt, A., Plant, N. (2007). A Probabilistic Expert System Approach for Sea Mine Burial Prediction, *IEEE Journal of Oceanic. Engineering, Vol. 32, No. 1*.

[18] P. C. Chu, T. B. Smith, and S. D. Haeger. (2001). "Mine Burial Impact Prediction Experiment," Institute of Joint Warfare Analysis, Naval Postgraduate School, Technical Report, NPS-IJWA-01–007.

[19] P. Valent, K. T. Holland, A. W. Green, S. Theophanis, C. King, M. D. Richardson, G. R. Bower, P. Congedo, and W. Lewis. (2002). "Observations of Velocities and Orientations of Cylindrical Bodies at Terminal Condition in Water," *Proceedings of the Fifth International Symposium on Technology and the Mine Problem*, Naval Postgraduate School, Monterey, CA, 22–25.

[20] A. Gilles. (2001). "Hydrodynamic Features of Falling Mine Detected from Drop Experiment," Master Thesis, Naval Postgraduate School, Monterey, CA.

[21] A. Abelev and P. Valent. (2004). "Dynamics of Bottom Mine Burial in Soft Sediments: Experimental Evidence and Predictions," Australian–American Mine Warfare Conference, 2004 Mine Countermeasures and Demining Conference, Canberra, Australia.

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Ft. Belvoir, Virginia

2. Dudley Knox Library
Naval Postgraduate School
Monterey, California

3. Rear Admiral David Titley, USN
Oceanographer and Navigator of the Navy
Washington, DC

4. Rear Admiral Jonathan White, USN
Commander, Naval Meteorology and Oceanography Command
Stennis Space Center, Mississippi

5. Rear Admiral/Professor Richard Williams
Chair of Mine Warfare
Wayne E. Meyer Institute of Systems Engineering
Naval Postgraduate School

6. CAPT Brain Brown
Commander, Naval Oceanographic Office
Stennis Space Center, Mississippi

7. CAPT Ashley Evans
Deputy Oceanographer & Navigator of the Navy
Washington DC

8. CAPT Robert E. Kiser
CommandingOfficer
Naval research Laboratory

9. CAPT Paul Oosterling
Exective Commanding Officer, Naval Meteorology and Oceanography Command
Stennis Space Center, Mississippi

10. CAPT Greg Ulses
Director of USW
Commander, Naval Meteorology and Oceanography Command
Stennis Space Center, Mississippi

11. Mr. Tom Cuff
Technical Director, Naval Oceanographic Office
Stennis Space Center, Mississippi

12. Mr. Ronald E. Betsch
MIW Program Manager
Naval Oceanographic Office
Stennis Space Center, Mississippi

13. Dr. James Rigney
Chief Scientist
Naval Oceanographic Office
Stennis Space Center, Mississippi

14. Dr. Peter Fleischer
Naval Oceanographic Office
Stennis Space Center, Mississippi

15. Professor Peter Chu
Naval Postgraduate School
Monterey, California

16. LT Chris Beuligmann
Surface Warfare Officers' School Command, Newport, Rhode Island